DOCUMENT RESUME

ED 315 642 CE 054 224

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TITLE Environmental Education through Adult Education. A Manual for Adult Educators, Instructors, Teachers and Social Extension Workers.

INSTITUTION African Association for Literacy and Adult Education, Nairobi (Kenya).

SPONS AGENCY German Adult Education Association, Bonn (West Germany).; United Nations Environment Programme, Nairobi (Kenya).

PUB DATE 87

NOTE 148p.

AVAILABLE FROM African Association for Literacy and Adult Education, P.O. Box 50768, Nairobi, Kenya ($10.00 plus postage; 10 copies or more: $7.50 plus postage).

PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC06 Plus Postage.

DESCRIPTORS *Adult Education; Community Education; Developing Nations; Economic Development; *Environmental Education; Extension Education; Foreign Countries; Forestry; *Health Education; Industrialization; *Population Education; *Rural Development

IDENTIFIERS *Kenya

ABSTRACT

The purpose of this manual is to make available to adult educators and field extension workers in Kenya resource material that may be used in formal and nonformal training programs for the environmental education of a wide range of target groups. The document begins with a 26-item glossary, an introduction, a section on the document's use, background and context material, a philosophy and rationale section, and a section on perspectives on adult education. Thereafter come four sections that contain concepts, principles, processes, problems, issues, and ideas that are relevant to the themes of environmental health; agroforestry and rural development; population, environment, and development; and urban/industrial development. Within these four sections are bibliographies with a total of 79 references. A section on methodologies and instructional aids concludes the document. (CML)

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ENVIRONMENTAL EDUCATION THROUGH ADULT EDUCATION

Edward B. Fagunwa

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ENVIRONMENTAL EDUCATION THROUGH ADULT EDUCATION

A Manual for Adult Educators, Instructors, Teachers and Social Extension Workers

Compiled and Edited by:
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ENVIRONMENTAL EDUCATION THROUGH ADULT EDUCATION

Published by:
African Association for Literacy and Adult Education
P.O. Box 50768, Nairobi - Kenya
in conjunction with
UNEP

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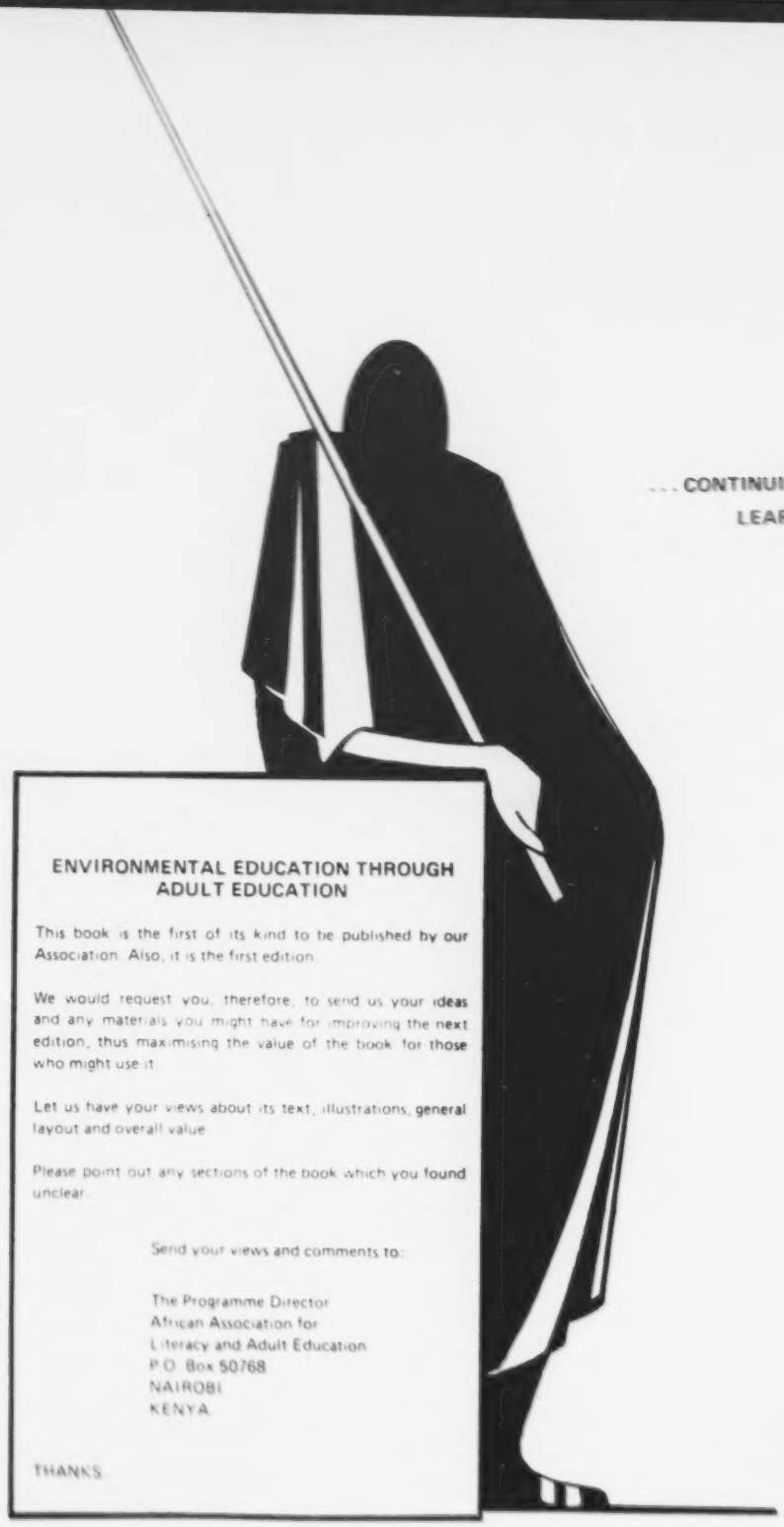
First Edition
1987

AALAE

UNEP

Printed by:
City Printing Works (K) Limited, P.O. Box 47764, Nairobi,
Telephone 22374/21859



. . . CONTINUING TO LEARN . . .

ENVIRONMENTAL EDUCATION THROUGH ADULT EDUCATION

This book is the first of its kind to be published by our Association. Also, it is the first edition.

We would request you, therefore, to send us your ideas and any materials you might have for improving the next edition, thus maximising the value of the book for those who might use it.

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and are acknowledged.

ACKNOWLEDGEMENTS

The publication of this Manual is the culminating point of a series of activities which have brought together, in a collaborative endeavour, many people and organizations, including members, friends, well-wishers, co-operating partners, organizations and institutions of the African Association for Literacy and Adult Education (AALAE).

On this occasion therefore, we would like to take the opportunity to express our gratitude and appreciation to all those who have been involved, in one way or another, in the successful accomplishment of this noble task.

First of all, we would like to acknowledge the contributions of all those from the various member Associations who participated in the Port Loko and Harare workshops, the output of which provided the framework, methodology and essential thrust of the Manual.

Secondly, we would like to thank the following Consultants whose Resource Papers provided the backbone of the Manual's content, and facilitated the satisfactory completion of the assignment:

From the University of Sierra Leone:
- Professor D. E. B. Chaytor
- Dr. A. B. S. Sillah
- Dr. Cyrus A. Macfoy
- Dr. H. Borbor Sama Kandeh
- Dr. Ogunlade R. Davidson

From Zimbabwe:
- Mr. Mark Chibanda
- Mr. Shasha Jogi
- Dr. David J. Muzita
- Mr. Ian MacLennan

Thirdly, Mr. Edward Rugumayo and Professor Victor Ibikunle-Johnson—the principal resource persons during this programme and the co-authors of this manual, and Mr. Nobert Kaggwa, the consultant artist responsible for the illustrations, design and lay-out of this manual.

Fourthly, AALAE would like to record particular gratitude to the following organizations and agencies for their contribution both in cash and kind, to a series of preparatory meetings, the two sub-regional workshops and other activities which preceded, as well as the final printing and publication of this Manual:

The United Nations Environment Programme (UNEP)
The German Adult Education Association (DVV)

Finally, our gratitude and appreciation go to the Canadian International Development Agency (CIDA) and Interchurch Co-ordination Committee for Development Projects (ICCO) whose financial contributions towards the core administration of the AALAE Secretariat provided the administrative infrastructure which enabled the Association to undertakethis activity as well as other programme activities.

March 1987
Nairobi, Kenya.

Paul Wangoola,
Programme Director.

GLOSSARY

ADULT EDUCATION is usefully defined as the process by which men and women (alone, in groups, or in institutional settings) seek to improve themselves, or their society by increasing their skills, their knowledge or their sensitiveness: any process by which individuals, groups or institutions try to help men and women improve in these ways.

AGROFORESTRY is a judicious integration of three natural production and management systems, namely, forestry, agriculture and pastoralism, in time and space, so as to increase the sustained yields and conserve the environment, in the interests of the welfare of the population. So, Agroforestry is a system of land use-cum-resource-management.

BACTERIA is a class of organisms which do not possess chlorophyll (the green colouring matter in plants): they usually multiply rapidly, by division. Bacteria occur virtually everywhere and are responsible, for example, for the souring of milk or the decay of dead animals. They can also cause and transmit many diseases, e.g. typhoid, tuberculosis, etc. They participate in the carbon cycle, can fix nitrogen in the nitrogen cycle, and decompose sewage and other organic matter into simple substances which can then be reincorporated into the biological cyles.

DEMOGRAPHY is the science of populations. Population is the number of individuals of a certain species (in this case humans) that live in a particular area at a particular time. The characteristics of these human numbers in terms of size, space, employment, composition and rates of growth as determined by deaths and migrations have important bearing on the environment, and hence on development of society.

DEVELOPMENT includes that which is a human-centred process aiming at satisfying human needs, both material and non-material through self-reliance, endogy and harmony with the environment.

ECOLOGY is the study of relations between animals, plants and the physical conditions of the environment; in particular the study of ecosystems.

ECOSYSTEM is a complete ecological unit which can be studied. It is a community which acts on the environment; and the environment acts on the community. An ecosystem consists of (a) producers, mainly green plants; (b) consumers, animals feeding on plants and other animals; (c) decomposers, mainly bacteria and fungi decomposing dead organisms.

ENDOGENOUS means stemming from the heart of each society, which defines its sovereignty, its values and the vision of its future.

ENVIRONMENTAL EDUCATION is an integrated process which deals with man's interrelationship within natural and man-made surroundings; it aims at developing a world population that is aware of, and concerned about the environment and its associated problems, and which has the knowledge, skills, attitudes, problems, knowledge, skills, attitudes, motivations and commitment to work individually and collectively towards a solution of current problems and the prevention of new ones.

FERTILITY: The rate at which the population replaces itself and grows depends on several factors. One of these is fertility which refers to the reproduction performance of females,

males or couples in a population. The production of live births in a population is related to the number of marriages, the age at marriage (or cohabitation), the availability and use of contraception and abortion (i.e. family planning), economic development, the educational and occupational status of women, age-sex structure and the overall quality of life.

HUMAN ENVIRONMENT consists of the surroundings including everything (living and non-living) with which a human being comes in contact, or interacts with; it has been defined as the stock of physical and social resources available at a given time, and in a given location, for the satisfaction of human needs and aspirations.

INDUSTRIALIZATION refers to the process of setting up industries, manufacturing goods, and so becoming industrialized.

MIGRATION: Populations are always on the move, both nationally and globally. The movement of populations or people across a specified boundary for the purpose of residing is known as migration. Along with *fertility* and *mortality* emigration is a component of population change. The terms emigration and immigration are used to refer to movements between countries.

MORTALITY refers to deaths as a component of population change. Although eventual death of every member in the population is taken for granted, the rate at which it occurs depends on many factors, such as age, sex, race, occupation, social class. Its occurrence can throw light on the population's standard of living and quality of life.

OCCUPATIONAL DISEASES are diseases which occur as a result of doing certain jobs e.g. lung diseases are associated with mining and factory work: progressive deafness to high intensity noise, etc.

ORAL REHYDRATION THERAPY (ORT). Diarrhoea is only one aspect, albeit an important one, in the complex web of childhood ill-heath. The prevention of mortality from diarrhoea by the use of oral rehydration therapy (ORT) is only a step in the strategy of dealing with the problem of diarrhoea. Oral rehydration solution consists of the basic ingredients of sodium, potassium bicarbonate and a suitable carrier substrate such as sugar. A simpler and easier formula consists of common salt and sugar made into a solution with boiled water using specified quantities. It is a safe method, simple and effective. It is economically affordable, self-sustaining and safe. It is a substitute for the more complicated intravenous feeding of the sick child. Mothers can easily prepare and administer oral rehydration solution.

POLLUTION is an adverse alteration to the environment by a *pollutant*. A *pollutant* is a substance or effect which adversely alters the environment by changing the growth rate of species, interferes with food chains, is toxic, or interferes with health, comfort, amenities, or property values of people. Generally, pollutants are introduced into the environment in significant amounts in the form of sewage, waste, accidental discharge, or as a by-product of a manufacturing process or other human activity. A polluting substance can be a solid, semi-solid, liquid, gas or even sub-molecular particle. A *polluting effect* is normally some kind of waste energy such as noise, heat or vibration.

PRIMARY HEALTH CARE (PHC) is a general strategy on approach to health which embodies explicit principles and values. These are equity and justice: an overall development strategy that gives high priority to social goals in addition to economic ones; people

imbued with a strong sense of self-reliance and control over their own lives, exercising responsibility over their own health. In short, a new health care strategy for all, in which people (or the community) participate to improve their own health and well-being.

PRIMARY INDUSTRY is the simplest form of industry which consists of the first processing of raw materials, e.g. the production of metal from mineral ores.

RECYCLE means to return to a previous state of a cyclic process, especially to convert (waste) to re-usable material.

RURAL DEVELOPMENT is a complex process of progressively achieving sustained improvement in the living and working conditions of usually disadvantaged populations in villages and isolated settlements away from urban centres. It is multidimensional, and multidisciplinary in its practical applications, involving economic, environmental, social, cultural, political and institutional aspects of human activity.

SECONDARY INDUSTRY covers a wide range of operations which include all re-processing of partially manufactured goods to make more complex products, e.g. the use of iron in machinery.

TERTIARY INDUSTRY is not a branch of manufacturing, but consists of service industries such as personal service, trade, transportation, etc.

URBAN STABILITY refers to the potential capacity of a country to continue to urbanize, given the size of its population, its level of economic development, the pattern of demographic growth, and the current balance between rural and rural urban residence.

URBANIZATION is associated with the development and growth of towns and cities. The term commonly refers to the concentration of formerly dispersed populations that are primarily engaged in farming in a small number of settlements whose principal economic activities are in the services, trade and manufacturing.

VIRUS: A very small (smaller than bacteria) infective agent capable of self-reproduction only in living matter. It is the causative agent of many diseases, such as hepatitis, Rickettisia, poliomyelitis, various types of cancer. The latest to be added to the list of diseases caused by viruses is the dreaded AIDS (acquired immune deficiency syndrome).

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INTRODUCTION

The preparation of this manual is the culminating point of a series of activities connected with the environmental education programme of the African Association for Literacy and Adult Education (AALAE). Environment and Development are priority areas in the AALAE programme of work; this is due to the recognition that it is necessary to let adult educators in the region have a thorough understanding of the nature of the human environment, its relationship with development, associated problems, and related issues facing their communities. Furthermore, it has become increasingly clear that an urgent need exists for available knowledge and information on relevant environmental problems and issues to be systematically incorporated into adult education programmes and activities using the best means and resources required for their dissemination. A major pre-occupation of AALAE therefore is the development of methods, strategies and resources for integrating environmental and developmental dimensions in adult education curricula and instructional materials.

The AALAE Environmental Education (EE) Programme began in 1979 with its first phase which consisted of a Regional Workshop on Environmental Education for Adult Education Professionals and Environmental Experts, held in Nairobi. This workshop identified the environmental problems of the region and produced a framework for future action in the context of environmental education. The second phase of the programme was the seventh biennial conference of the then African Adult Education Association (AAEA) which was held in Luyengo, Swaziland the following year (1980) on the theme: "Environmental Education through Adult Education Programmes". Outline modules on selected environmental themes were produced during this conference. The themes included Health, Agroforestry, Population and Urban/Industrial Development.

Two sub-regional workshops for Adult Educators, who were also curriculum development specialists, were held as part of the third phase of the programme. The first, for the English-speaking West African sub-region was held at the Women Teachers College Port Loko, Sierra Leone, April 1984; the second, for the central and southern Africa sub-region was held at Seke Teachers College, Harare, Zimbabwe, September 1984. Participants in both workshops, using the materials produced from the 1980 Swaziland Conference, undertook to review, update, expand and develop further the content and methodologies of environmental education modules and instructional materials on the four themes, taking into account the environmental conditions and circumstances of the respective sub-regions. The combined output of these sub-regional workshops have been used to prepare the content of this manual. The present document therefore represents the cumulative efforts arising from the 1979 Nairobi Experts Workshop, the 1980 Swaziland Biennial Conference and the 1984 Port Loko and Harare sub-regional Adult Educators Workshops to evolve practical ways of disseminating knowledge of environmental problems and issues in adult education programmes which are aimed at developing environmental awareness and understanding among rural and urban communities.

This manual contains consolidated material on some basic aspects, facts and principles, on each of the four environmental themes considered. Each theme is accompanied by extensive bibliography and reference materials, a case study and examples of teaching units, together with indications of appropriate methodologies and audio-visual support aids. Separate chapters are given to essential guidelines in the theory and practice of adult education, general methodologies, instructional aids, and evaluation procedures. A glossary of terms is included both to provide a common understanding of some of the terms used in the manual and to aid comprehension of the concepts and ideas generated.

The purpose of this manual is to make available to both professionals and practitioners in adult education, to teachers, instructors and field extension workers, a resource material which may be used in training programmes (both formal and nonformal) for the environmental education of a wide range of target groups, but more especially for the practical training of those who will be involved with people at the community or grass-roots level. The Manual may also be used as a reference document in matters related to education and training on environmental matters as defined within the scope and limits of the themes considered.

HOW THE MANUAL MAY BE USED

The contents of this Manual are intended to be a source of concepts, principles, processes, problems, issues and ideas which are relevant to the four environmental themes considered. The materials presented are no doubt related to desirable knowledge, skills and attitudeds which are required for personal, community and national development. These materials may therefore be usefully included in any environmental-education programme for adult education, and provide a useful basis for the design of instructional materials.

Environmental health, population issues, agroforestry in rural development and urban industrial problems are only four of the major environmental issues affecting the life of the African environment. But they cover a sufficiently wide spectrum of environmental problems, on which the African peoples must be provided with basic knowledge, awareness and understanding. It is also noted that there is considerable overlapping among the four themes: for example, pollution of one kind or another, appears in each of these themes, each of which covers various aspects of development.

The Manual also contains some brief guidelines and hints on the process of adult education as well as a number of factors to be taken into consideration in the education and training of adults. Furthermore, there are notes that give relevant strategies and methodologies which may be usefully employed for the suggested activities. Some instructional aids and media resources are also suggested to facilitate the teaching/learning process and to aid comprehension. All these suggestions are by no means exhaustive; on the contrary, they may be considered as samples from a more comprehensive array of methods, procedures, media and audio-visual aids. Each user of the manual is expected to employ, as much as possible, all available resources and facilities that are appropriate to his situation, to the nature and level of the target group(s), and to the circumstances in which instruction is taking place. The instruction of the user, his capacity for innovation, and his ability to improvise, are all as important as the guidelines provided in this manual.

(a) *PROGRAMME DEVELOPMENT*

For instructional purposes, a user of this manual may go through the following steps in the planning, design and implementation of teaching/training based on the contents of this manual:

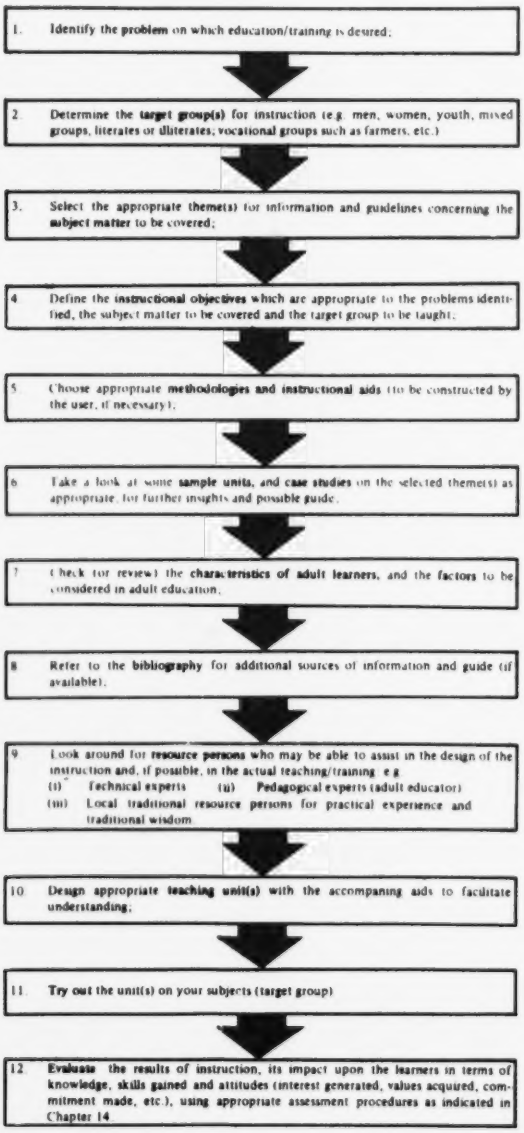

1. Identify the **problem** on which education/training is desired;
2. Determine the **target group(s)** for instruction (e.g. men, women, youth, mixed groups, literates or illiterates; vocational groups such as farmers, etc.)
3. Select the appropriate theme(s) for information and guidelines concerning the **subject matter** to be covered;
4 Define the **instructional objectives** which are appropriate to the problems identified, the subject matter to be covered and the target group to be taught;
5 Choose appropriate **methodologies and instructional aids** (to be constructed by the user, if necessary);
6 Take a look at some **sample units, and case studies** on the selected theme(s) as appropriate, for further insights and possible guide;
7 Check (or review) the **characteristics of adult learners**, and the factors to be considered in adult education;
8 Refer to the **bibliography** for additional sources of information and guide (if available);
9 Look around for **resource persons** who may be able to assist in the design of the instruction and, if possible, in the actual teaching/training e.g.
(i) Technical experts (ii) Pedagogical experts (adult educator)
(iii) Local traditional resource persons for practical experience and traditional wisdom
10 Design appropriate **teaching unit(s)** with the accompaning aids to facilitate understanding;
11. **Try out** the unit(s) on your subjects (target group)
12. **Evaluate** the results of instruction, its impact upon the learners in terms of **knowledge, skills gained and attitudes** (interest generated, values acquired, commitment made, etc.), using appropriate assessment procedures as indicated in Chapter 14.

Fig. 1: ***Programme development, step by step.***

The contents of this manual may also be used as a resource for the following purposes; the procedure followed would vary according to the needs and requirements of each particular case:-

(b) *CURRICULUM DEVELOPMENT* —The materials contained may be used to develop a curriculum in environmental education for a range of levels in adult education.
(c) *FUNCTIONAL LITERACY PROGRAMMES* —Facts, figures and principles (connected with the environmental problems and issues discussed) may be incorporated in literacy materials as a means towards generating environmental awareness and understanding, especially in vocational contexts (e.g. for farmers, fishermen, village technicians, etc.)
(d) *TEACHER EDUCATION* —The manual content should also provide materials for developing environmental education for the training of teachers and other instructors for adult and other kinds of education.
(e) *AS A REFERENCE DOCUMENT* —The material contained in the manual together with its extensive bibliographies may be used for reference purposes by students, teachers, lecturers, trainers and other professionals requiring information (facts and figures) theory and applications of knowledge on the environmental problems and issues which form the main thrust of this document.

6

BACKGROUND AND CONTEXT

Fig. 2: *Family in search of a safe hiding place.*

Africa is currently facing four major problems that cut across national boundaries. These are drought, famine, desertification and political instability. Although they may be concentrated in one country, the effects of each of these problems can be felt in neighbouring countries and beyond.

Climatic conditions usually do not obey or observe artificial national boundaries. As a consequence of this, drought has been felt throughout the breadth and length of the region without discrimination. It has affected those countries where both democratic and dictatorial regimes are in existence.

In the wake of drought the region has suffered from one of the worst famines ever recorded in which over 100 million people are affected, and thousands of lives are daily lost, ranging from the infants to the oldest members of society. Ethiopia, Chad, Somalia, Sudan, Mozambique, to mention only a few countries, have all been seriously affected by famine. The outstanding feature common to all of these countries is political instability. An unstable country or society which spends a good portion of its time, human and material resources engaged in civil strife and conflict has little time to devote its energies and resources to produce enough food for its people, let alone prepare in advance for the drought.

Another effect of political instability is the problem of refugees, those unfortunate individuals who run away from their countries of birth to escape the threat to their own lives, and in search of a safe hiding place. The Africa region now boasts of housing more than half of all the world's refugees. Many of these refugees have run into countries whose basic industrial and social infrastructure are ill-equipped to take on extra loads such as extra mouths feed, extra numbers to attend school or extra patients to be attended to by over crowded and overstretched medical and social services.

Fig. 3: *Desert is expanding; extending its sand to areas once capable of supporting life.* — Source UNEP

Fig. 4: *People cause deserts; only they can stop them.*

The fourth problem is that of desertification. It could be argued that people in some areas of Africa have lived with the desert for many centuries, and therefore there is nothing new as far as this problem is concerned. There is a lot of sense in this. But what makes the problem of today's desert more alarming is that it is actually increasing, expanding, and extending its cover, or sand and scrub to those areas of land which some few years ago were supporting, or capable of supporting, domestic animals, food crops, and even had forests and rivers flowing. This process of expanding desert is called desertification.

By carefully studying past historical records, as well as recent ones, of many countries throughout the world, a conclusion as to the cause of desertification has been reached. This is the unpleasant conclusion that "people cause desertification—only they can stop it."

We now have touched on all the four major problems—drought, famine, desertification and political instability. Each of these problems, either separately or together, seriously reduce the resources which have to be spent on the development of the people of the respective countries in the region.

But before these problems became severe and reached these magnitudes, the various governments had spent a good deal of resources on health and education to the extent that people's health and general standard of living had improved well beyond what the former colonial powers could have dreamed of. As a result of these efforts, the populations of the region are very young i.e. about 50 % are under 15 years of age, and continue to rise at an overall rate of about 2.5 %, with some countries' rate of increase as high as 4 % per annum. (i.e. the population of those countries would double in 17½ years).

The convergence or coming together of all those problems has made life very difficult for the majority of the people in the region. They are the ones who are affected most by the drought, desertification, famine and political instability. They also constitute most towards population increase.

Rapid population increase has also added to the problems of the continent. This is not a problem of absolute numbers but relative numbers to the available resources of food, health care, education, housing, land and other basic necessities of life.

Last but not least is the problem of urbanisation. This is the migration or movement of people from the rural areas to the towns resulting in overcrowding, creating shanty towns (or slums), and lowering the standard of living of the majority of urban dwellers. Most of the urban dwellers are not supplied with the basic and adequate amenities of potable water, fuel for cooking, housing, health care and refuse disposal. These complicate the living conditions of urban/slum dwellers to the point where they live in abject misery, with high birth and infant mortality rates, unemployment, unschooling, lack of recreational amenities etc.

Fig. 5: *Women and children suffer most from famine, drought and political instability.*

A number of these urban dwellers are employed in industries where they are exposed to the dangers of industrial pollution, noise, accidents, excessive exhaustion and inadequate feeding leading to many of them contracting diseases which result from an interaction of all these and many other factors.

However, it is only a minority of the continent's people who live in the towns. The majority live in the rural areas, say about 85 %. In most of the region's countries, the rural inhabitants

(peasants) produce the bulk of food to feed the nation and the cash crops for export to earn foreign exchange for the governments to buy the necessary (and sometimes unnecessary) imports. Recently, the tendency in many countries has been the drift to the towns by the rural youth—both men and women, but mostly males.

The drift from the rural areas has deprived these areas of active and able-bodied individuals resulting in communities inhabited mostly by the very young and old. This in turn has caused a drop in production of food, the cutting down of trees and vegetation, and the gradual deterioration of the environment leading to desertification.

Another cause of famine has been the undue emphasis on growing of cash crops at the expense of food crops. Together with urbanisation, leading to rural urban migration, the amount of time and energy spent on the growing of food crops has been seriously reduced, leading to famine.

Thus the selection of the four themes which go to constitute this manual is based on this background. It so happens that the four themes represent the two principal and fundamental human activities which constitute mankind's very existence. These two are: production of the basic necessities with which to maintain human existence, (agroforestry, industry and urban development) and reproduction of the human race for purposes of continuity (population and environmental health).

But more importantly is the fact that these four themes are the ones in which the majority of the regions' population are either engaged, or by which they are affected.
It is therefore the role of adult education to popularise this approach so as to make it part and parcel of their methodology.

The four themes contained in this manual are intended to contribute appropriate resource material towards the improvement of the overall health of the majority of the people in the African region. Because they touch on many aspects of our very existence—on agriculture and forestry, industry and the towns, health and population— the themes therefore cover enough ground to bring in those principal elements which go to constitute a healthy mind in a healthy body in a healthy environment.

In considering the four themes we have to bear in mind that they result from human activities, and they take place on this planet. In other words, we carry out all these activities within the *environment* or *surroundings*. These comprise the land, water, air, human activities, living organisms and humankind as a whole, as well as the social institutions it has created. Thus the environment is a sum-total of all the above. When we deal with environmental health we take into account the physical natural environment and man-made environment; those aspects which would give rise to ill-health, and those which would enhance one's health and general well-being.

7

THE PHILOSOPHY AND RATIONALE OF ENVIRONMENTAL EDUCATION and The AALAE Programme

The goal of the AALAE Environmental Education Programme is to achieve a high level of environmental literacy in Africa, leading to the improved use of the environment, its development, and improvement in the quality of life for the peoples of Africa. To that extent, the programme seeks to promote awareness and understanding of environmental issues and problems among rural and urban communities through the integration of environmental dimensions into adult education programmes. To achieve this long term objective, and to sustain the manpower development of a cadre of well-trained adult educators who will implement such programmes, there is urgent need to develop suitable manuals and instructional materials.

The process of development is now understood to be one which tries to fully adapt man to his environment. Given that the basic goals of any society are to provide to all its citizens basic subsistence, security and shelter, the functional relationship between societal well-being and environmental management is a one-to-one relationship. Until the physical and social resources (which make up the human environment) are developed, resulting in the enhancement of the quality of life, and generating enlarged individual consciousness, society is defined as underdeveloped. A society is underdeveloped if for some reason it cannot take full advantage of its manpower potential and available technical resources. For many African countries, the main environmental problems have their roots in the social, economic and political ramifications of underdevelopment. It is therefore futile to isolate man, his aspirations, his frustrations, and his triumphs from his social and physical environment. It is the individual who is interacting with his environment who knows best what dimensions are relevant and need manipulations to increase his adaptation or satisfaction. The factors and forces which have contributed to Africa's environmental and developmental problems are innumerable, but the major ones appear to be rapid population growth, underdeveloped economies and misuse of economic resources, political instability, illiteracy, ineffective social welfare and educational programmes.

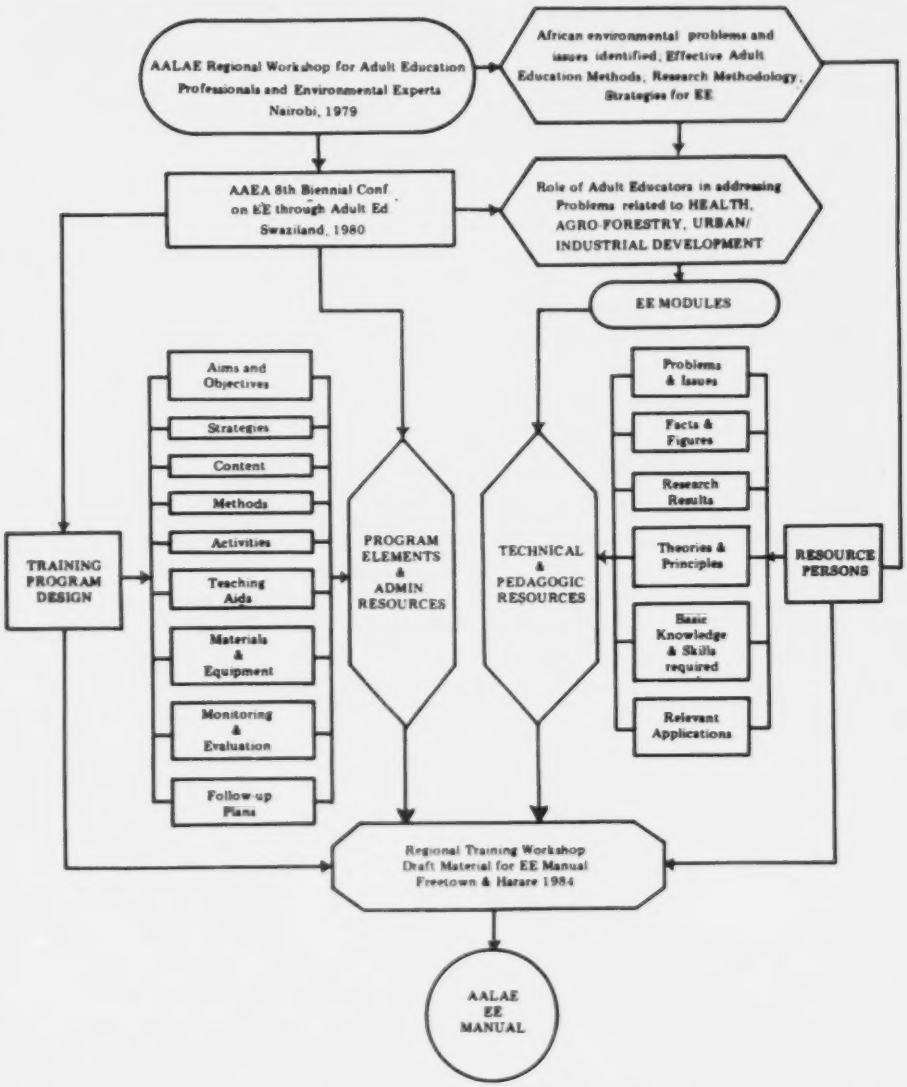
These concerns need attention and solutions. While the main responsibility for solution lies with African Governments and the provisions of programmes they make to achieve improvement in these areas, it is the moral obligation of voluntary and non-governmental organisations and institutions to understand the existence of these problems and how they hinder development, and assist their governments in all possible ways to achieve these solutions sooner than later. Such approach would also help to increase the citizen's support for, and participation in, developmental programes.

The AALAE Environmental Education Programme recognizes among the tremendous waste of resources through lack of literacy and basic education. Given the native intelligence of people, in both the rural and urban areas, they can with basic education rise up to the challenges and opportunities especially in the area of HUMAN NEEDS. Therefore the programme is designed to stimulate this kind of developmental activity. It is based on the belief that people, especially in the rural areas in Africa, are not very different from people in rural areas elsewhere; they can with some support, tackle and solve their problems.
In the context of rural development, this programme is perhaps different from other programmes with similar goals in that it is human-centred, needs-oriented, endogenous, and self-reliant, and that facilitators of development programmes must be in direct and continuing contact with the grassroots. The realization that without motivation and participation development misses the mark, leads to a new emphasis on the role of adult education in development—and to the complex set of questions about literacy, functional skills, community participation and mobilization. The Adult Educators must be able to go to the villages and learn from the people, share knowledge and experience, tap from their rich store of empirical knowledge and traditional wisdom. The development we talk of must be based on *self-reliance*, and should focus on improving upon what has been, and what exists: exchange of ideas and experiences which will help the people help themselves.

Therefore, the development which the AALAE Environmental Education Programme seeks to stimulate and support must be:-

People-centred and needs-oriented —geared to satisfying the basic needs of the people in order to raise the quality of their lives through participation and improved environmental management practices;
Endogenous —stemming from the heart of each society, which defines into sovereignty its values and the vision of its future.
Self-Reliant —relying on the strength and resources of the society which pursues its own development, and rested at the local level in the practice of each community;
Ecologically-sound —utilizing rationally, available resources in a harmonious relation with the environment.
Based on structural transformation — Originating in the realization of the conditions for self-management and participation in decision making by all.

THE AALAE PROCESS IN PREPARING A MANUAL FOR EE THROUGH ADULT EDUCATION IN AFRICA


AALAE Regional Workshop for Adult Education Professionals and Environmental Experts Nairobi, 1979
African environmental problems and issues identified; Effective Adult Education Methods, Research Methodology; Strategies for EE
AAEA 8th Biennial Conf on EE through Adult Ed Swaziland, 1980
Role of Adult Educators in addressing Problems related to HEALTH, AGRO-FORESTRY, URBAN/ INDUSTRIAL DEVELOPMENT
EE MODULES
Aims and Objectives
Strategies
Content
Methods
Activities
Teaching Aids
Materials & Equipment
Monitoring & Evaluation
Follow-up Plans
TRAINING PROGRAM DESIGN
PROGRAM ELEMENTS & ADMIN RESOURCES
TECHNICAL & PEDAGOGIC RESOURCES
Problems & Issues
Facts & Figures
Research Results
Theories & Principles
Basic Knowledge & Skills required
Relevant Applications
RESOURCE PERSONS
Regional Training Workshop Draft Material for EE Manual Freetown & Harare 1984
AALAE EE MANUAL

8

PERSPECTIVES ON ADULT EDUCATION

Adult Education has been generally defined as the process by which men and women (alone, in groups, or in institutional settings) seek to improve themselves, or their society, by increasing their skills, their knowledge, their understanding or their sensitiveness: any process by which individuals, groups or institutions try to help men and women improve in these ways.

Adult Basic Education (ABE) includes literacy and numeracy (the skills of reading and handling numbers). Functional literacy combines the teaching of reading with the teaching of another skill, in a programme related to a given community, in a given environment, and to a given economic and social development plan.

Vocational Training in the context of adult education is more narrowly defined and more specific than education, since it is designed expressly to enable adults to understand their work, perform it more effectively and advance within it; but it may be seen as part of adult education, since it is concerned with changes in skills, knowledge and ideas, and relies on the same principles.

Adult education as an integral part of *lifelong education* can contribute decisively to economic and cultural development, social progress and world peace, as well as to the development of educational systems (UNESCO). In the context of development, the whole purpose of adult education is to help people contribute to, promote, and participate in national development.

Environmental Education for all adults (and in particular in the context of adult education), should include the identification of environmental problems and issues, collection of environmental information and its dissemination to appropriate institutions, development of alternative solutions to environmental problems, and development and implementation of education/training action plans (linked with functional literacy where appropriate) for youths and adults at different pedagogical levels.

Some important factors and conditions to consider for the effective education of adults may include:—

(1) The *interest* of the adults must be stirred in order to *motivate* them to learn;
(2) Learning must be centred on *experience*,
(3) Learning must be focussed on *problems;*
(4) The adult learner must be adequately motivated to change his/her behaviour;
(5) He/she must be aware of the inadequacy in his/her present knowledge, skill or behaviour;
(6) The adult learner must have a clear picture of what *gains* in knowledge or skill, or what changes in behaviour he/she will achieve;
(7) The adult learner must have opportunities to put his/her new knowledge, skill or behaviour into practice;

(8) The adult learner must have *reinforcement* of newly learned behaviour;
(9) The adult learner needs the support of a sequence of relevant and appropriate study *materials*.
(10) A clear *perception* of the problem must be stimulated;
(11) An appropriate *setting* and suitable *methods* must be chosen.

30

9

THEME I

ENVIRONMENTAL HEALTH IN THE ADULT EDUCATION CURRICULUM

9.1 INTRODUCTION

The human environment is considered here as comprising those external physical, chemical, biological and social factors that have a significant and detectable effect on the health and well-being of the individual, or of communities of people. Health itself can be regarded as a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity.

Every nation should seek to improve the well-being of its citizens, i.e. to develop them economically and socially and spiritually. This should be so because enjoyment of the highest attainable standard of health is one of the fundamental human rights without distinction of race, religion, political belief, economic or social condition.

9.2 BASIC PRINCIPLES OF ENVIRONMENTAL HEALTH EDUCATION

Before the adult educator launches this programme, it is important to be clear about the basic principles of environmental health education. The following is an outline of these principles:

1. The basic starting point and unit of health education is the individual and the home.
2. Adult Education is an agent of environmental health education and Primary Health Care.
3. Environmental health education should aim at systematically developing and raising the level of awareness in individuals and communities, of their health requirements.
4. This awareness should give rise to demands for community action, prevention of disease, and development of skills and facilities for Primary Health Care.
5. Community participation should be emphasised to ensure a lasting interest in new ideas and practices of environmental health education among the people.
6. Good health promotes both individual and social development.
7. The main thrust of environmental health education should be on prevention and eradication of disease. The thrust on preventive medicine is aimed at improving the physical amenities, and meeting the basic hygiene needs of the people.
8. Health education should inculcate and promote values attitudes and life styles conducive to good health.
9. Environmental health programmes should form an integral part of social and economic development planning to improve the living and working environment of the people.
10. By introducing new ideas, concepts and practices among the community, adult educators are likely to meet with some strongly held but sometimes erroneous

views, attitudes, and practices. These should be handled with *tact*, *sympathy* and *understanding* so as to pave way for the success of the programme.

9.3. MAJOR PROBLEMS AND ISSUES

In this section an outline of principal problems and issues is given. It focuses mainly on causes, nature and extent of environmental health problems.

1. Environmental health problems originate in socio-economic, political and behavioural activities, and their solution lies in the same activities.
2. Economic and socio-political factors such as unplanned industrial development, unemployment, lack of adequate nutrition, water supply and hygiene, rural-urban migration leading to heavy concentration of population in the urban areas, are injurious to health. So are racism, alcoholism, stress, violence, drug and tobacco abuse, as well as of aggression of people by other people.
3. The nature and extent of environmental health problems.
4. Problems related to rural environment.
5. The main causes of environmental health problems, factors contributing to spread of disease, pollution and contamination problems, and their control.
6. The role of traditional medicine, superstition and "untrained doctors", and culturally induced environmental health problems and issues.
7. The importance of modern medical practices and health services and their limitations.
8. The identification of major problems and issues for each given community.

9.4. GENERAL OBJECTIVES

Before setting out to launch any educational programme, the educator must state clearly, in simple terms, the general objectives of the programme. This exercise clarifies in his/her own mind what it is that the programme intends to achieve, through his/her efforts and those of the community. For the purposes of this section, five such objectives are stated.

1. To make people aware of the health needs of the community as they relate to development.
2. To make people aware of the link between health and overall development of the community.
3. To draw attention to the interaction between the socio-economic and political activities and environmental health of the people.
4. To encourage individuals and groups to stimulate creative action with a view to improving individual and community health.
5. Most diseases are preventable.

9.5. SPECIFIC OBJECTIVES

Using the standard educational media, the adult educator should demonstrate to the adult learners, and with them carry out investigative work to prove the following:

1. Diseases are found everywhere: in air, water, food; as chemical agents, carried by humans, animals, plants and micro-organisms.

2. Flies also carry germs (bacteria) which cause certain diseases such as dysentery, eye-infections, etc.
3. Parasitic (helminthic) infections may be caused by parasites found in dirty (polluted) water supply, unclean food, poorly disposed excreta, etc.
4. Other types of organism, e.g. mosquitoes, fleas, lice, etc. carry other types of disease such as malaria, yellow fever, river blindness (*Onchocerciasis*), plague, etc.
5. Certain domestic animals (cats, dogs, chicken, etc.) carry fungal diseases (e.g. coccidiodomycosis) to humans; and rabid dogs and cats transmit rabies to humans through their bites.
6. Other types of disease-causing agents include viruses. These cause diseases such as poliomyelitis and infectious hepatitis, fungi causing e.g. athlete's foot and ring worm; and rickettsia causing typhus and trench fever.
7. In order to reduce, cure, eradicate and prevent disease, certain specific steps have to be taken.This is only possible only when the disease has been studied and understood. Immunisation of children for poliomyelitis, tuberculosis, tetanus, etc., and taking anti-malarial tablets are forms of preventing these dangerous diseases.
8. Certain injurious chemical agents are encountered by inhalation of fumes, gases, dust and vapours; or may be pollutants of water, food, soil and air, both, at work home and elsewhere.
9. Some of the steps necessary for prevention, cure, and elimination of disease can be effectively taken through community participation.

9.6. STRATEGIES FOR ACHIEVING THESE OBJECTIVES

Having stated the basic principles, major problems and issues, and general and specific objectives of the programme, the next step is to formulate a workable methodology which would be a function of these and at the same time facilitate their realisation. Thus adult education becomes an agent of Primary Health Care.
The process of acquiring better habits can be speeded up by the education of adults, e.g. women, through Welfare Centres, Women's Institutions and Primary Health Care Centres where they can receive instruction on the principles of hygiene, mothercraft and better ways of living. Instruction in the home by health visitors is a continuation of this form of education.

People should be convinced that some of their sanitary habits and feeding practices perpetuate disease, and therefore the adoption of appropriate habits and practices will improve their general health and well-being. These new habits and practices, combined with community participation, will solve the common environmental health problems.

In order to realise these objectives the following *STRATEGIES* are recommended:
1. Adult education and literacy through a study of selected science topics intended to introduce the basic elements of aims of science and the scientific method.
2. Health education programme(s) combined with community participation.
3. Basic science topics and health education and community participation (this is a combination of strategies 1 and 2).
4. Environmental planning with a view to the provision of good sanitation, safe-drinking water, and pollution-free air.

5. Balanced environmental planning of industrial development, town planning and integrated development of rural areas, with a view to preventing diseases, congestion and squalor.

9.7. METHODOLOGIES TO BE USED TO ACHIEVE THESE OBJECTIVES

Achieving the above objectives is not an easy task. It may involve the use of all methods of education and teaching aids.
Some of these methods may include:-

1. Case study methods.
2. Conference/Clinic.
3. Demonstration.
4. Discussion groups.
5. Field trips.
6. Laboratory.
7. Role playing.
8. Panel discussion.
9. Workshop.

Here is an example of a combination of three methods, namely discussion, field trips and workshop, and how they may be employed to transmit a message through community participation or involvement in order to solve a common health problem.

(a) The *discussion-method*—as its name implies is the exchange of ideas between learners and teachers aimed towards achieving a stated learning objective.
(b) *Field trip(s)*: This method enables students/learners to visit a realistic environment which provides the sights, sounds, equipment or operations that are directly connected with the purpose of the instruction.
(c) *Workshop*—Is a gathering of students/teachers emphasising free discussion and practical methods, skills and application of principles. These principles may have been understood by participants previous to the workshop or acquired by them in the course of the workshop.

9.8. INSTRUCTIONAL AIDS REQUIRED

For any method to be effective it would need appropriate instructional aids to accompany it so as to achieve its stated aims and objectives.
The following are considered appropriate instructional aids:

1. *Displays and Exhibits*—A collection of visual aids e.g. pictures, graphs, charts, models, books, tools, etc. These permit learners to see things related to the topic and problem which they are studying.
2. *Films*—Sound motion pictures, silent film, lantern slides, film strips, T.V. and videotape, etc. These can be used with any of the methodologies.
3. *Media*—Radio, Newspapers, handouts, posters, etc.

9.9 BASIC KNOWLEDGE AND SKILLS REQUIRED OF THE ADULT EDUCATOR

To enable the adult educator to effectively carry out these educational duties, he would be required to possess the following basic knowledge and skills:

1. The use of the microscope.
2. The use of educational teaching aids as described above.
3. He should have undergone a minimum of six weeks training in health-related fields.
4. Communication skills, i.e. the ability to teach both literate and non-literate adults.

9.10 FACTS AND FIGURES RELATED TO THE THEME

In many developing countries especially in Africa, ignorance, illiteracy, poverty, poor environmental and other cultural factors are said to be responsible for high infant morbidity and mortality rates. The life expectancy is estimated between 40-42 years male and about 45 years for female. Many children die before reaching the age of 5 years.

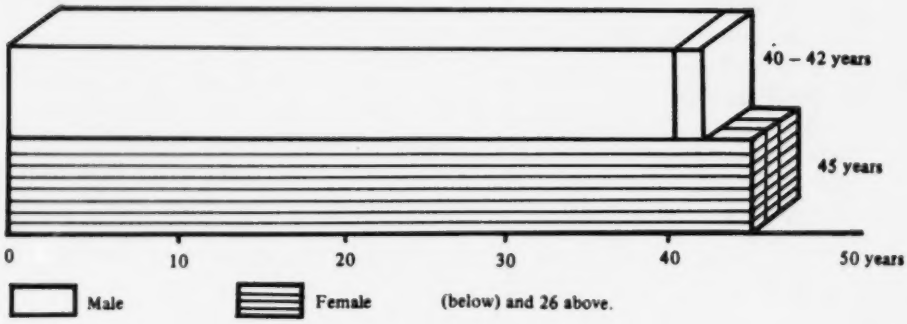


Fig. 6: *Estimated life expectancy in developing countries.*

In Sierra Leone, for example, the infant mortality rate stands at 225/1000. Neo-natal death rate is 34 % of all infant deaths. Neo-natal mortality is estimated at 245/100,000 live births and life expectancy averages 34 years. The crude death rate is 28/1000 total population and a high birth rate of 47/1000 total population results in a high growth rate of 1.9 % per year.

Factors which contribute to poor environmental health include: poor environmental sanitation and personal hygiene, lack of health education, unsafe and inadequate water supply, overcrowding, ill-ventilated houses, lack of proper refuse collection and disposal system and malnutrition. Additionally, lack of adequate maternal and child health services, school and community health services, immunization programme, family planning and modern farming techniques and methods further complicate the already difficult situation.

Available statistical data reveal that (10) ten major diseases caused by these deplorable conditions are:

1. Malaria.
2. Respiratory diseases e.g. pneumonia
3. Diphtheria.
4. Malnutrition.
5. Diarrhoea.
6. Tuberculosis.
7. Measles.
8. Polio-myelitis.
9. Whooping Cough.
10. Tetanus.

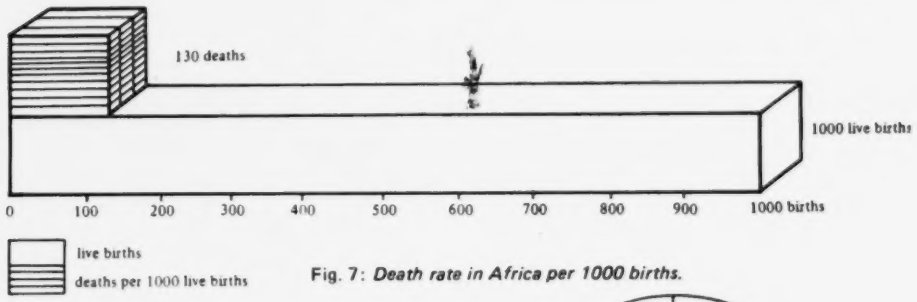


Fig. 7: *Death rate in Africa per 1000 births.*

studies carried out in Africa also proved that the death rate is as high as 130 deaths per 1000 live births. Among these, the undermentioned are the diseases and their percentages in Sierra Leone

1. Measles 22%
2. Diarrhoeas and other excremental diseases 15%
3. Malnutrition 30%
4. Other diseases e.g. tetanus, whooping cough, tuberculosis, etc. 33%.

It is further estimated that 80% of the population of Africa living in rural areas have no access to drinking water. Women and children have to walk several kilometres in search of water.

The two tables which follow show:
(1) the role of water in the spread of some serious diseases.
(2) the percentage reduction of disease by water improvement.

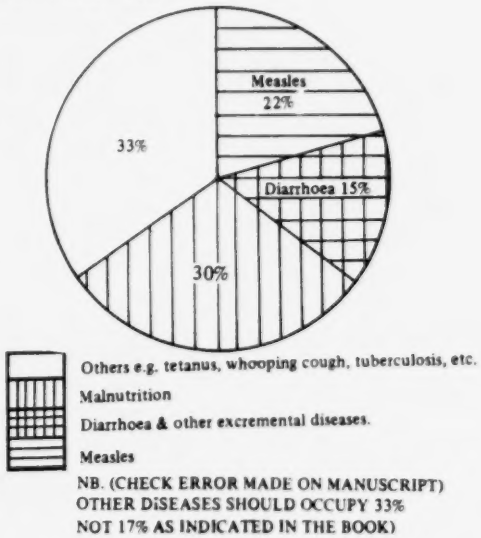


Fig. 8: *Children's killer diseases in Sierra Leone.*

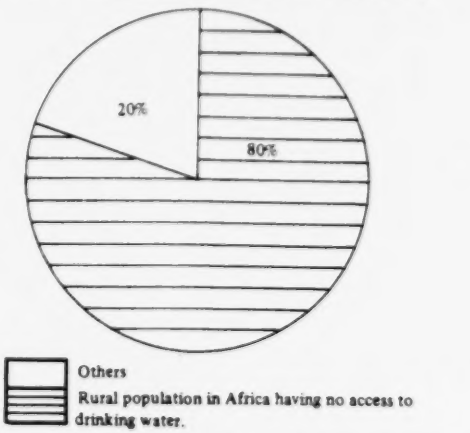


Fig. 9: *Percentage of rural population having no access to drinking water.*

Table I

The role of water in the spread of some serious diseases

Disease	*Infectious Agent*	*Role of Water*
Bilharziasis	Helminth Worm	Direct transmission/skin/ penetration
Diarrhoea/enteritis	Symptoms of many agents	Direct transmission/ingestion
Hepatitis (infectious)	Virus	Direct transmission/ingestion
Cholera	Bacteria	Direct transmission/ingestion
Typhoid fever	Bacteria	Direct transmission/ingestion
Ascariasis	Helminth worm	Direct transmission/ingestion
Dracontiasis	Helminth worm	Direct transmission/ingestion
Amoebic dysentery	Protozoa	Occasional transmission
Bacillary dysentry	Bacteria	Occasional ingestion
Malaria	Mosquito	Vector habitat
Filariasis	Mosquito	Vector habitat
Onchocerciasis	Blackfly	Vector habitat
Yellow fever	Mosquito	Vector habitat
Flukes	Helminth worm	Habitat of intermediate host

Table II

Percentage reduction of disease by water improvement

Disease	Estimated reduction by water improvement (%)
Cholera	90
Typhoid	80
Hepatitis (infectious)	10 (?)
Bacillary dysentery	50
Amoebic dysentery	50
Gasroenteritis	50
Scabies	80
Yaws	50
Leprosy	50
Diarrhoea Diseases	50
Ascariasis	40
Schistosomiasis	60
Guinea worm	100
Sleeping sickness	80
Onchocerciasis	20 (?)
Yellow fever	20 (?)
	(after Bradley in Feachem 1977)

In 1980 in the developing countries, an estimated five million children under 5 years of age—about 10 every minute—died as a consequence of diarrhoeal disease. Diseases like onchocerciasis (River blindness) and bilharziasis (Red gonorrhea) are

endemic in certain parts of Africa. The prevalence of these diseases is strongly associated with the breeding of the simulium fly and the presence of a particular type of snail in the ponds, stagnant pools and streams, respectively.

The need for the integration of a Primary Health Care delivery system into the existing health and medical services at the grassroot level has been emphasized by the World Health Organisation. Primary Health Care will definitely make a noticeable impact in any given situation which is aimed at improving the overall health status of the community. From the foregoing, it can be deduced that most of the causes of mortality and morbidity in developing countries can be prevented, minimized, or eradicated if only there are available and accessible educational facilities and opportunities aimed at educating the adults to realize and value their health as community assets by practising habits that are conducive to good health. These must be supported by strong policies of Governments on adult education and environmental health.

9.11. AVAILABLE RESEARCH RESULTS AND RELEVANT APPLICATIONS

Available Research Results

Though a lot of research work has been carried out on environmental health education, very little has been done related to the African continent. Research on environmental health education in Africa has shown that:

1. Where a community is predominantly illiterate it is important to begin with literacy, in a language in which the programmes will be conducted; and this must be a local language most widely spoken and understood by the adult learners, as one of the vehicles of environmental health education.
2. By acquiring the literacy skills, adults tend to identify themselves more with their society and feel confident in solving their own community problems.
3. Literacy increases adoption of new and improved agricultural and health practices and has effect on the farmer's attitudes towards new ideas.
4. Occupational hazards are also encountered in the work environment i.e. industry, agriculture, mining, etc.
5. Mental health is also influenced by several environmental factors which include psychological, physiochemical and biological factors.
6. Many environmental factors e.g. poverty, ignorance and cultural practices fundamentally interact to produce nutritional diseases, caused by insufficient food of high nutritive value, uneven distribution of food within the community and even within the family.
7. Most African cities are not able to supply even 60 to 90 litres of water per capita per day. More than 60 % of the population of Zambia, Malawi, Mozambique, Cameroon, Upper Volta, Angola, Ivory Coast, Sierra Leone and Somalia did not have piped water in 1965. Only 5 % of the urban population in Niger and 10 % of the urban population in Nigeria, Ghana, Mali, Mozambique, Somalia, Cameroon, Central African Republic and Upper Volta were served by house connections.
8. The sanitary systems in most of the black African cities is much below the standard required for healthful living.
9. In many developing countries it is observed that the major environmental problems have their origin in the social, economic and political ramifications of under-development.

10. **Relevant applications of research results being made:**
    (a) Literacy programmes to include language most widely spoken and understood by adult learners as one of the vehicles of environmental health education. Hence, all materials specifically designed for adults should tell straight forward life histories of common diseases, supported by well written and designed texts to act as the first major steps in bringing about conviction and awareness among learners.
    (b) Programmes of functional literacy and community participation—these arouse their interest in learning and motivate them; learning must be centred on experience, and focused on problems.
    (c) Education of adults e.g. women, through welfare centres and women's institutions where they can receive instruction in the principles of hygiene, mothercraft and better ways of living.
    (d) Immunization programmes and taking of antimalarial tablets. Appropriate and correct feeding practices, moderate drinking, careful driving, non-smoking; defaecating and urinating only in latrines.
    (e) The United Nations has, therefore, declared 1981—1990 the International Drinking Water Supply and Sanitation Decade.

9.12. EVALUATION

Assessment/Evaluation Procedures

Modern teaching methods require the teacher to have an up-to-date picture of the progress made by the students who are undergoing instruction. These are appropriate methods of assessing or evaluating the progress students are making at different times during the course of the programme. While earlier methods placed emphasis on testing and examining students at the end of the course or term, modern methods combine end-of-course or term assessment with continuous assessment carried throughout the entire course/programme. In addition, provision is made for the teacher to assess his/her performance in achieving the objectives of his/her programme.

In order to assess the effectiveness of an instructional programme, the evaluation/assessment aspect must be included in the programme itself right from the beginning.

Continuous assessment is sometimes referred to as *formative* evaluation, i.e. it assesses the formation and understanding of new ideas and attitudes in the learner resulting from exposure to the programme using the instructional methodologies recommended.

The other kind of evaluation is the one that is carried out at the end of the project/programme. This assesses the overall impact the programme has had on its recipients/participants, whether it has in fact achieved the objectives it had initially set itself to achieve.

There is also self-evaluation by the teacher which seeks to inform the teacher (using an educational check-list accompanying the course programme) about the effectiveness of the course, its methods and strategies, etc. Examples of all these forms of assessment are included in this theme. (Sample Units: Onchocerciasis and Diarrhoea).

9.13. CASE STUDIES

Case study 1 — Onchocerciasis (River Blindness)

Farmers in a plantation field about 500 yards from a river in the savanna zone of Sierra Leone. In this village little or no preventive medicine is practised. There is a small clinic and several traditional herbalists to satisfy the health needs of this population. There is no medical entomologist even at a distance of about 300 miles, and no hospitals are in sight for at least 50 miles. A farmer observes a swollen nodule on the pelvic region of his skin. He takes no positive step to find out the cause, but goes on with his daily routine lifestyle. After several months, his eye-sight has rapidly deteriorated. He can no longer see clearly. It is now that his relatives decide to take him to the clinic where he is referred to the Eye Hospital about 100 miles away. After various examinations it is diagnosed that this farmer has *Onchocerciasis* i.e. river blindness.

Fig. 10: *Diagnosing River Blindness.* — Source UNEP.

Fig. 11: *Victims of River Blindness.* — Source UNEP.

POINTERS

- *Clothing* — Must be worn and must be preferably dark as this attracts less insects.
- *Nodules* — When bitten by the insect, and/or at first appearance of nodule, farmer should report immediately to the clinic superintendent.
- *Education* — The farmer makes no conceptual link between insect bite and eventual blindness. Thus this point must be developed and emphasised.
- *Cultural aspects* — Culturally, river blindness is regarded as a 'curse' in some societies. This must be corrected.
- *Tests* — Routine skin test in endemic areas.
- *Entomology* — Spraying of endemic areas with insecticide by qualified personnel under supervision by an entomologist.
- *Research* — Into the development of a vaccination for river blindness, among other things.
- *New Villages* — Must be located away from infested areas.

Case study 2 — Diarrhoea

Location: Small village containing 300 inhabitants in a Western Rural Area of Sierra Leone. This particular household consists of a husband and wife and 5 children, with ages ranging from 6 months to 15 years. Hygiene and sanitation are poor and include a small pit latrine with no cover, that satisfies 40 people in the surrounding area. Some people in this village still use the bush or the sea for disposing their excreta. All seven of the residents live in a single over-crowded bedroom. Tap water is obtained from a tap about 500 yards down the road, or from a well, or a stream nearby.

The 6 months old child is no longer being fed from the breast but from a cup that any and everybody have access to. His diet is mainly rice porridge and water twice everyday. The child starts having frequent watery stools and this continues for 4 days with no improvement. Child is dehydrated and vomits a lot. He loses appetite and becomes very ill after about a week.

The mother then takes the child to a herbalist about a mile up the hill. This inexperienced herbalist then diagnoses the cause to be the result of the mother being unfaithful to the husband. Meanwhile the child gets worse, as he is now being completely starved as treatment recommended by the herbalist.

Finally, neighbours convince mother and father of necessity for child to visit health clinic in the village. Oral rehydration is administered together with antibiotics, as a result of which the child recovers.

POINTERS

- *Poverty* — Over-crowded household.
- *Hygiene* — Very poor e.g. latrine uncovered, water supply inadequate, other people in.
- *Sanitation* — Surroundings use unhygienic excreta disposal systems. Flies, for example, can therefore transmit infective micro-organisms to food.
- *Nutrition* — Inadequate and unbalanced food; weaning foods necessary.
- *Sickness* — Report immediately to clinic.
- *Traditional Medicine* Care, as methods are not yet properly investigated in most countries.

9.14. SAMPLE UNITS

Environmental Diseases — Types and Causes

Topics: 1. Onchocerciasis.
2. Diarrhoea.

Generalisations

1. People are exposed to many diseases in their environment such as diarrhoea and onchocerciasis.
2. Children and adults are likely to catch these diseases.
3. There are various ways of controlling (preventing and curing) these diseases.
   (a) by practice of personal and environmental hygiene e.g. protecting food and water from flies; proper disposal of refuse and human waste; eradication of transmitting agents.
   (b) by immunization.

Specific Objectives

Learners should be able to:

1. Know the causes of diarrhoea and onchocerciasis.
2. State methods of preventing and curing these diseases.
3. State the advantages of preventing these diseases by immunization.
4. Explain why children are more likely to catch these diseases than adults.
5. Appreciate that "prevention is better than cure."

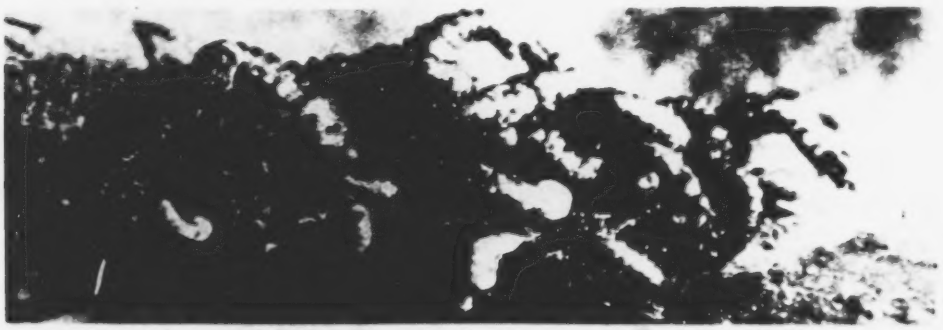


Fig. 12: *Simulium larvae, enlarged to seven times, life size.* — Source WHO.

TOPIC 1 Causes, Prevention and Cure of Onchocerciasis

1. Lead a discussion on the causes of onchocerciasis
   The session should bring out the following:-
   (a) A simple understanding of the life cycle of the parasite responsible for causing river blindness emphasising that the parasite is introduced from the saliva of the insect to man. The nodules are reservoirs of the parasite. The parasite moves to the eye through the skin where it causes blindness.
   (b) The linkage between insect bite and eventual blindness—that the insect bite introduces the worm which takes some time to get to the eyes.

That individuals vary in resistance, thus some people would be bitten but do not develop blindness. Others, if bitten by an uninfected insect will not develop blindness. When the insect bites an infected man it takes in the parasite, so when it bites another it introduces the parasite to this second individual.

(c) The cultural misinterpretations of the causes of blindness.

(d) The socio-economic aspects of river blindness e.g. reduction of labour force in community.

2. Learners should discuss ways of preventing and curing onchocerciasis e.g.

(a) The need to use preventive measures and how these can reduce the incidence of blindness.

(b) Wearing clothes—preferably dark clothes.

(c) Locating new villages away from infested area.

(d) Reporting for routine test at nearest clinic, especially those in endemic areas.

(e) Reporting when bitten by the insect and at first appearance of nodule, to the nearest clinic.

(f) Pesticide spraying with suitable insecticide by qualified personnel.

(g) Creating awareness of the dangers of some cultural practices and beliefs.

(h) Dangers of bathing in rivers in endemic areas.

Fig. 13: *Washing and bathing in rivers infested with onchocerciasis.*

Assessment

1. State the cause of Onchocerciasis and where this disease is endemic in your community.
2. State the relationship between the insect and blindness.
3. Are there any cultural beliefs regarding the cause of river blindness in your community? Discuss.
4. Discuss the effects of river blindness on a population.
5. Discuss what should be done when bitten by the *Simulium* insect.

TOPIC 2. Causes, Prevention and cure of Diarrhoea.

1. Lead a discussion on the *causes* of diarrhoeas.
   The discussion should bring out the

following issues:

(a) Poor environmental and personal hygiene with regard to the handling of foodstuffs, feeding, eating and cooking utensils.
(b) Improper protection of food items against transmitting agents.
(c) Improper disposal of refuse and human waste.
(d) Inadequate breast feeding.
(e) Untimely introduction of weaning foods.
(f) Some cultural practices and beliefs with regard to child weaning.
(g) Poor and inadequate water supply.

Fig. 14: *Unprotected food may be attacked by ants and other agents of diarrhoea.*

Fig. 15: *Defecating on the ground spreads diarrhoea.*

2. Learners should discuss ways of preventing and curing diarrhoea e.g.

(a) Keeping the environment clean and observing the rules of personal hygiene.

(b) Proper protection of food items against transmitting agent.

(c) Proper disposal of refuse and human waste.

(d) Longer period of breast feeding.

(e) Introduction of the right types of weaning and provision of supplementary food items.

(f) Creating awareness of the dangers of some cultural practices and beliefs.

(g) Provision of clean and adequate water supply.

(h) Introduction and application of oral rehydration therapy (ORT), using ORT formula and numeracy.

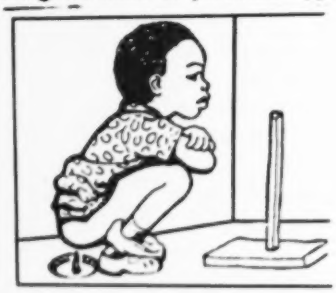


Fig. 16: *Proper disposal of human waste.*

Fig. 17: *Keep proper rules of hygiene – defecating in the toilet.*

3. Learners should discuss the advantages of preventing diseases by immunisation bringing out the following:
   (a) It is cheaper to prevent disease than to cure it.
   (b) A healthy community is sustained.
   (c) It is easier to measure the effects of immunization.
   Learners are to decide on a Community Health Project to reinforce the idea that "Prevention is better than cure."
4. Learners should discuss why children are more likely to catch diseases than adults
   (a) Children have low resistance to infection because of their age;
   (b) Children are likely to have poor nutritional status due to cultural behaviour of adults with regard to eating habits.
   (c) Children are more vulnerable to worm infestation.
   (d) Lack of proper nutrition education may result in non-adherence to the rules of hygiene.
   (e) Unavailability of proper medical and health services.

Teaching Aids

1. Picture showing poor environmental and personal hygiene conditions.
2. Picture showing a child defecating on the ground (watery stools).
3. Picture showing food left uncovered with flies on it.
4. Two pictures, one showing young child being breastfed, another showing a child being fed with artificial body food.
5. Film on "water means life". Picture showing women walking long distances to fetch water.

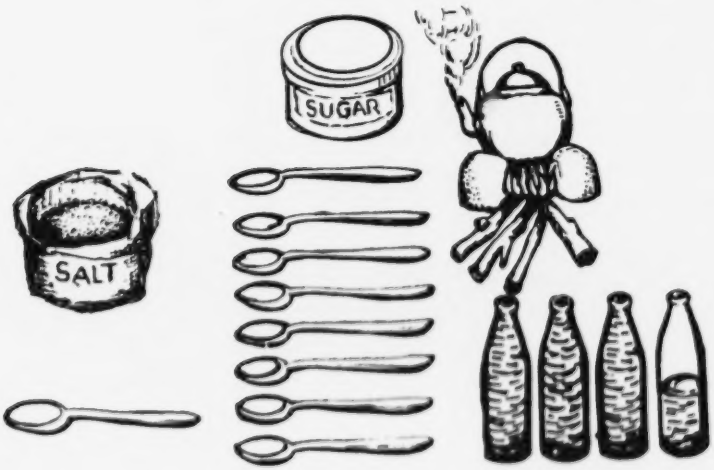
Fig. 18: *Extended breast-feeding is better than early weaning.*

Fig. 19: *Women walk long distances to fetch water.*

Assessment

1. State the causes of diarrhoea.
2. Observation of sanitary practices in the community e.g. disposal of refuse.
3. Inspection of the community to determine its cleanliness.
4. Discussion of preventive and curative measures of diarrhoea, emphasising preventive measures.
5. Explain why children are more likely to catch diarrhoea.
6. Preparation of ORT to cure diarrhoea.

Making Oral Rehydration Solution from Salt and Sugar



9.15 OUTLINE OF CONTENT TOPICS RELATED TO THE THEME

The foregoing sample units and case studies are selected to illustrate what can be done in the course of teaching environmental health education to adults. The examples are not exhaustive. The selection of other content topics related to this theme will depend on the importance attached to various health problems as they affect each given country, district or locality. But the guiding rule in selecting the topics should be immediate relevance and concern to the local community.

The following are the proposed topics:

1. *The home* —Location, sanitation, individual and family health, diet, and work.
2. *Water* —The availability and provision of potable water within easy reach of the home and institutions.
3. *Food* —Adequate, balanced, regular cultivation, storage, use of pesticides and other chemicals in food production and preservation.
4. *Maternal and Child Health* —Both children and mothers tend to suffer most when there is food and water crisis; how to cater for their health and well-being.
5. *Fuel* —Renewable, non-renewable, alternative sources, etc.
6. *Diseases* —Water-borne, vector-borne, and communicable; preventive and curative measures, sanitation, including sewage and garbage disposal; pollution and other occupational diseases.
7. *Family Planning Population Planning* —To consider the role of family size, health, economic aspects, pros and cons of family planning, using both traditional and modern methods.
8. *First Aid* —To explore the traditional methods and medicines used in first aid, modern methods of dealing with the same problems. The problems would include burns, bone fractures, snake bite, shock, poisoning, etc.

9.16 ADDITIONAL RESOURCES

Films, Audio Visual Aids, Posters, Film-Strips, Vehicles, Trained Personnel references

TOPIC 3 Bilharzia

Objectives

1. To educate and make people aware of bilharzia and how the disease is transmitted.
2. To demonstrate and inform people about the life cycle of bilharzia and how the cycle can be broken.
3. To inform people about what constitutes safe and unsafe water.
4. To equip people with knowledge, skills and attitudes which will enable them to take measures to keep their water supplies free from bilharzia e.g. the building and consistent use of Blair and other types of toilets.

5. To encourage and support families and communities in the digging and construction of safe, clean and protected wells on self-reliance basis.
6. To explain the signs and symptoms of the disease.
7. To motivate people to take preventive and curative measures to keep their families and communities free from bilharzia.
8. To inform people about the medical facilities available from the diagnosis and treatment of the disease.
9. To explain how the disease is cured.
10. To dispel the many misconceptions and fears people have about the disease.

BACKGROUND INFORMATION

There are many misconceptions and fears regarding bilharzia held by the people who suffer from the disease in many parts of the world. Bilharzia is a human parasitic disease caused by worms which do not multiply in the human body but which live in the blood vessels of the small intestines or bladder where they lay vast number of eggs that are passed out either in urine or faeces.

In Zimbabwe there are two species of bilharzia worms that are of medical importance. These are *Schistosoma haematobium* which infect the bladder and *Schistosoma mansoni* which usually infect the small intestines. Other organs of the body can also be affected. Acute infection is a result of the damage caused to organs and tissues by trapped eggs of the worms. Any organ of the body can be damaged including such vital organs as the brain, spinal cord, the liver and kidneys. In general the common symptoms of the disease are: Lethargy, aches and pains as well as debility. Depending on the species, blood is usually noticed in the urine and faeces.

Occurrence:
Bilharzia is a tropical disease which is closely associated with running or stagnant water which is polluted by human wastes. Bilharzia occurs in many countries of Africa, e.g. in Egypt, Algeria, Northern Sudan and countries in west, central, east and Southern Africa, as well as in Asia.

In Zimbabwe the disease is endemic. A recent survey showed that 70% of the school children in the rural areas where surface water (dams and rivers) is available suffer from this debilitating disease.

Fig. 21: *Using water infested with bilharzia.*

Diagnosis:

There is only one sure way of diagnosing bilharzia infection. This is demonstrating the presence of the eggs in the urine or faeces as well as in the tissues and organs of the human body. This can only be done through laboratory tests conducted at a clinic or hospital. No tests can be valid during the development stages of the worms and a person must wait approximately six

weeks after exposure before he can be tested properly.

Mode of Transmission.

The disease can be contracted by paddling, swimming and washing in, or drinking infected water.

Life Cyle of the Parasite

There are 4 distinct phases in the life cycle of the bilharzia parasite. (see Fig)

1. Worms living in the definitive host (human) lay vast numbers of eggs into the small blood vessels of the bladder or intestines which are passed out in urine or faeces.
2. The eggs are passed into fresh water where they swell and hatch producing free living larvae called miracidia (singular: miracidium)

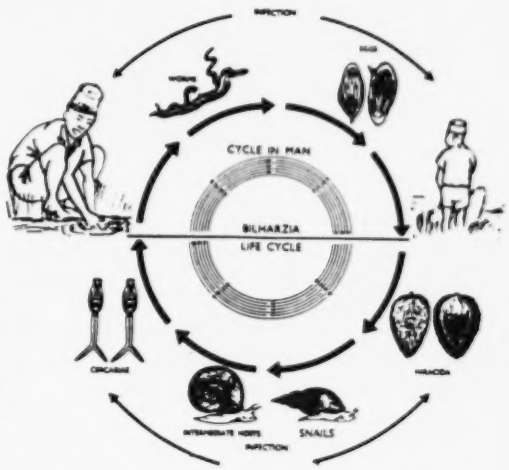


Fig. 22: *Life cycle of a bilharzia parasite.*

3. The miracidia are microscopic in size and they search for the appropriate fresh water snail. Once the miracidium finds the host snail, it burrows into the snail's tissues where the process of development is completed. Hundreds of free—living larvae called *cercarie* emerge from the snail.

4. The cercarie attach themselves to the skin of human being who comes into contact with the infected water. They bore through the skin and migrate to the liver via the blood system. After some period of development in the liver, worms pair up (female and male) and migrate to the bladder or small intestines where they live and lay eggs. Bilharzia is not transmitted directly from man to man. It passes from man to water, to snail, and back to man when he/she comes into contact with infected water.
5. Early diagnosis and treatment prevent the numerous complications of the disease such as enlargement of the liver or spleen, mental disorder and sterility.
6. All the above can be achieved by intensive health education and community participation in the identification of problems and appropriate solutions through prompt and correct action.

Suggested Activities

1. Local Health Official to arrange a meeting of elders, politicians, opinion leaders and members of the community to discuss the problem of Bilharzia in the area and come out with possible solution and a plan of action.
2. Show film posters on bilharzia.
3. Demonstrate how Blair (and other types of) toilets are built, how they are used, etc.
4. Build with the people a demonstration Blair toilet, protected well in the area.
5. Clear weeds round nearby rivers, dams, etc.
6. Community should plant weeds poisonous to bilharzia-carrying snails.

Prevention and Control

1. People must be aware of the danger of passing stools and urine into open water sources.
2. People must purify water for drinking and washing and avoid contact with infected water bodies.
3. Improved hygiene and sanitation are essential for good health. Man is an integral part of the worm's life cycle, and if people refrain from contaminating water, the disease will disappear.
4. Chemicals should be sprayed on contaminated water bodies to break up the life cycle of the disease.

Fig. 23: *A protected water spring.*

5. Remove weeds along banks of rivers or dams so as to eliminate the snail's favourable habitat.
6. Protected water supplies (piped water, spring, protected wells) prevent people from using river or dam water.
7. Arrange a visit to an area where proper health practices are being carried out.
8. Produce and distribute booklets/pamphlets in appropriate languages on bilharzia and related health issues.

Case Study 3

Family X lives in Chiwororo village near a dam. They have 5 children aged 5-20 years They own 23 head of cattle and some chicken. The family does not have either toilet facility or protected source of water for their domestic use. They get their water for drinking, cook - ing, etc. from the dam which also provides drinking water for animals in the village. Since the age of 5 their children have been swimming, urinating and playing near the dam together with their friends. Adults also do the same, in addition to fishing. When in the dam, none of the people wear protective clothing. In the dam there are fish, lots of snails and weeds on the banks.

After some time the father started feeling general weakness, frequent need for urination, followed by a burning sensation in the male organ, and then blood started to appear in the urine. Worried, the father went to the local n'nga (traditional doctor) who gave him some herbal medicine which did not improve his condition.

One of the family's neighbours who served on the local village Health Committee heard of the plight of his friend. He visited him and advised him to seek advice from the village health worker. On seeing the man, the village health worker visited him immedia- tely for diagnosis and treatment.

The man went to the clinic taking along his urine and stool for laboratory examination. The examination revealed that the man had bilharzia (chifunga) parasites. He was given

appropriate treatment. He was cured. Later on, members of his family showed similar symptoms. He did not waste time consulting the N'nga. He took them straight to the rural health centre where they were given appropriate treatment for bilharzia.

The village community got together to find a solution to the problem of bilharzia. Through the advice of the Health Officer, and through their combined effort, they constructed a deep protected well and a blair toilet for each family. They cleared the dam of all the weeds and snails. Within one year, bilharzia had been eliminated from the village of Chiwororo

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10

THEME II

AGROFORESTRY AND RURAL DEVELOPMENT

10.1 ESSENTIALS OF RURAL DEVELOPMENT

We begin with the basic assumption that the process of national *development* is one which tries to fully adapt people to their *environment*. This assumption is derived from the basic goals of any society: i.e. to provide adequate welfare for all citizens in terms of basic subsistence (food), clothing, security and shelter. It is further understood that the environment consists of the stock of physical resources at a given time and in a given location, for the satisfaction of human needs (food, shelter, clothing, health, education and productive work), and aspirations.

Rural development is a complex process of progressively achieving sustained improvement in the living and working conditions of usually poorer populations in villages and isolated settlements away from urban centres. It is multidimensional and multidisciplinary in its practical applications, involving economic, environmental, social, cultural, political and institutional aspects of human activity.

Rural development is primarily a development of people individually and collectively, their environment, bodies and minds — physical, social or emotional. The target of rural development is the rural poor, and the effects should be the eradication of their poverty, the achievement of equity in the distribution of economic and political power, and increased participation of the people in national life. When fully developed, rural areas should be integrated with urban areas "into mutually supporting networks of production and exchange." Rural development is therefore regarded as a modernization effort designed to provide the basic amenities of modern life to the rural areas, while maintaining their essential character and purpose. It seeks to raise the standard and quality of rural life, not to transform the rural areas into urban centres. The rural areas even when developed should remain the bread basket of the nation. Urbanization could well make them unsuitable for large-scale food production. Rural development should make rural life attractive, especially to the young and able-bodied population who will stay in the rural environment to effect the improved production.

Integrated Rural Development can be regarded as a socio-economic, political and cultural process by which the inhabitants of rural areas attempt to improve all aspects of their living conditions. The process depends on the participation and critical awareness of the people in the rural areas in the project themselves, so that they can change their situation and overcome the problems in their community.

The concepts of rural development and integrated development have important implications: some of these arethose concerned with the *education* of the population to enable their participation in the very demanding development plans of this new perspective in rural, development. Education obviously has a very important role to play; and within this field adult education is most important of all.

10.2. A STATEMENT OF THE PROBLEM

FOOD and FUEL have become the biggest problems for African countries, many of which now spend more than 25 per cent of their national budget on oil imports alone. The food problem, relating to both production and availability, can be traced to a mixture of neglect and competition for land use. The last 10–12 years have seen the neglect, particularly of peasant agriculture by many governments. There has been a preference for growing export crops which benefit the few to production of food crops.

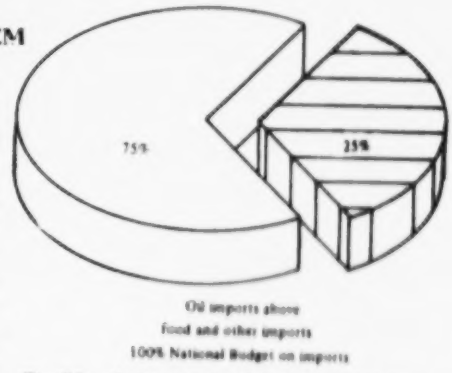

Fig. 24: *Average national budget expenditure on oil imports in African countries.*

This preference increased 4 to 10 times in the Sahel region alone, in the case of cotton, while food production declined steadily to reach its biggest drop in 1982, to 15 per cent in 17 of Africa's poorest countries. By 1982 the Food and Agriculture Organization (FAO) Director General was calling for massive food aid of 5.4 million tons to 150 million people in 24 African countries in sub-Saharan Africa, where the food production failures had reached crisis proportions. The situation threatens to remain difficult in the coming years in some countries.

Fig. 25: *Causes of disappearance of tropical forests.*

The problem of food production is largely one of rural development which is slowest in Black Africa (Lele, 1983). Although some 80 per cent of our population live in the rural areas, development efforts have been concentrated largely in urban centres over the past quarter of a century. The peasants still practise their fishing and agriculture in the same old ways by canoe and slash-and burn methods respectively.

Furthermore, a body of evidence suggests that the world's forests are being depleted at an alarming rate: approximately 11.3 million hectares are cleared annually, and this constitutes 0.6 per cent of the total resources. The ratio of reforestation to deforestation is low, beign 1:4 in Asia, and 1:29 in Africa (FAO, 1981). In the case of the latter, the main cause is *shifting cultivation*. The second most important cause is the gathering of *firewood* (Amara, 1983) or

Fig. 26: *Shifting cultivation and use of fuelwood are some of the major causes of deforestation in African countries.*

fuelwood. Millions of people in developing countries depend on shifting cultivation for the bulk of their food, and on fuelwood for cooking and heating.

Increases in human populations and expectations indicate that shifting cultivation or bushfallow is no longer practicable in developing countries. As these two parameters increase, fallow periods are shortened, accelerating an alarming rate of *soil deterioration*, and critically decreasing basic *food crop yield* precisely as needs are increasing (Bishop, 1983).

It is not often realized, even in agricultural circles, that there is a close inter-relationship between agriculture and forestry, and that there are many benefits which forests can confer, and do confer, on agricultural pursuits. Among other things, forests are well known to prevent soil erosion, regulate stream flow, prevent desert encroachment, and increase the number of rainy days; factors which are vital for stable agriculture. Its ironic that by removing the trees to grow more crops, we put these crops at risk. Indeed, a real conflict exists between agriculture and forestry in the allocation of the use of the land. This is particularly so in the high forest zones where the timber-producing areas are also the same lands required for rubber, oil palm, cocoa, coffee, etc. The temptation of much quicker returns from agricultural crops, but not necessarily the most profitable, has often led a number of developing countries to decide to sacrifice the forest estate in favour of agricultural development.

The above problems result in poor yields of food crops, acute *ecological* and *socio-economic consequences*. It is often the old people and the young children that suffer most. Almost 34 per cent of African children in Sub-Saharan Africa are undernourished and the number seems to be growing, as more and more land becomes drought-stricken. Already 44 per cent of the continent's land is hit by *drought* which continues to spread. It is clear therefore, that some practical alternative to shifting cultivation, etc., must be found soon if the massive impairment of material and human resources should be arrested. Evidence exists to show that this can be achieved through judicious integration of forestry, agriculture and pastoral land-use systems. This integration is what is called *Agroforestry*.

10.3. QUESTIONS FOR DISCUSSION

1. What are some of the problems of the rural areas in your country, which must be taken into account in any integrated rural development planning?
2. What opportunities exist in your community for the people to effectively participate in the planning process and in decision-making?
3. In what ways can appropriate education help to generate awareness and sensitivity to the problems of the rural area, and equip them with the necessary knowledge, skills and attitudes to stimulate desired change?
4. What are the factors affecting
   (a) Agriculture (b) Forestry,
   (c) Fishing (d) Livestock breeding in your rural area?
   In what ways are the people seeking solutions to problems in these areas?

10.4. WHAT IS AGROFORESTRY?

10.4.1. The Nature and Attributes of Agroforestry

Agroforestry is a type of farming in which the growing of crops is combined with the growing of trees and/or the production of livestock at the same time from a piece of land on a sustained yield basis. The trees may be fuelwood, shade, fruit or timber; the crops may be either food-crops or cash-crops; the livestock can be cattle, sheep, goats, chickens or wildlife.

Agroforestry may thus be defined as a judicious integration of three natural production and management systems, namely, forestry, agriculture and pastoralism, in time and space so as to increase the sustained yield and conserve the environment, in the interests of the welfare of the population. It implies both ecological competition and ecological interdependence of the trees, field crops and livestock.

Fig. 27: *The villagers are part of the agro-system.*

Constant (1982), provides the following definition: "Agroforestry develops the concept of using trees as a component of the overall management of land resources to meet the needs of the people for food, fuel shelter and income. The system used needs to be socially, culturally and economically acceptable to maximize total output at given input levels, and to minimize damage to the total environment."

Agroforestry is therefore a way of reconciling the conflicting needs of native farmers and foresters through a constructive change in the pattern of shifting cultivation. It aims at optimizing the use of land resources, stabilizing the environment and providing stable products of food and trees. Thus it combines land use with resource management, and is particularly suitable for marginal lands and low input systems. Nair (1983) recently summarized the important attributes that explain the current recognition of agroforestry in scientific circles. He pointed out that as a land use system agroforestry appeared to meet the following acceptable conditions:

(a) it allows production of wood products and food at the same time from the same piece of land;
(b) it does not depend on high value inputs;
(c) it conserves the ecosystem yet offers sustained production from the land;
(d) it is compatible with the socio-cultural and economic conditions of the farmers.

Agroforestry should *not* be regarded, however, as *the* answer to *the* problem of agricultural production. It might well turn out that, like the green revolution, it is more a or less specific solution that fits only certain given socio-economic and/

or ecological situations. Thus King (1968) has suggested that for the success of agroforestry, there must be in the rural areas (i) land hunger, (ii) under-employment, and (iii) low standard of living.

10.4.2. **The Scope of Agroforestry**

Agroforestry includes annuals and biennials like grains, cassava, pulses, banana, etc.; perennials like Gmelina, teak, etc. for timber and firewood; or citrus, plums, and breadfruit trees plus animals like sheep, cattle, poultry, pigs, fish, for food, hides, organic manure; plus also ornamental shrubs for horticultural products. All these are integrated in various ways and combinations into a cultural practice that would give optimum yields in the given situation. But it is still a matter of trial and error experimentation as to which particular combinations would be both compatible and productive for maximum outputs.

Agroforestry may be aimed at forest growth to check growing desertification in arid lands; or it may be aimed at crop production when trees form a green belt to protect field crops and livestock from dust, storms, excess solar radiation; or to protect pastures for animal rearing while at the same time affording browsing and fodder. The emphasis will vary with the needs of the farmers.

In the traditional village agroforest, the vegetation structure of the agroforests, i.e. the physical arrangement of plants over space and time is similar to tropical forest ecosystems. The principle underlying their establishment is the same. In places where coffee is the main crop we get a mixed coffee-shade species system of three layers.

—The first layer is coffee;

—The second layer could be a shade tree or fruit production species like *Citrus* sp., *Musa* sp. (banana), *Mangifera indica* (mango), or fruit and timber production species;

—The third layer is mainly a timber tree layer.

AGROFORESTRY

AS AN INTEGRATED FORM OF LAND USE

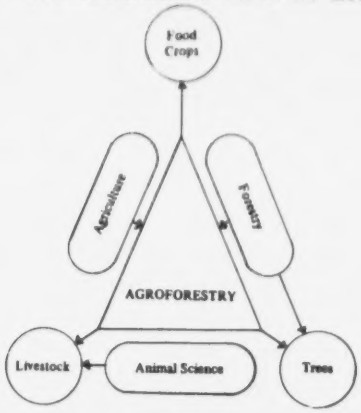

Fig. 28: *A diagramatic representation of the agroforestry system.*

The above patterns, or combinations, are familiar sites in West African compounds or tree crop farms of many small holder farmers. In many rural areas in Sierra

Leone for example, cocoa or coffee, kola nuts and sometimes coconuts and citrus fruits are grown together in forested areas. The tree species are thinned out, leaving only the desired species of plants. Occasionally, the tree species when mature may be used for timber, but more often it is the branches that are used to provide firewood. Once the stage of food production is reached the cash crops (cocoa, coffee or kola nuts etc.) are harvested annually and sold locally to augment the income of the farmer who may be engaged in rice farming or other farming activity at other times of the year.

Livestock is an important component of the agroforestry. Chickens, sheep and goats freely graze or are fenced in sheds and fed with forage gathered from the agroforest or from outside (e.g.) rice fields, namely weeds, leaves, or twigs of perennial crops. The animals contribute to the output of the agroforest and have an important role in nutrient cycling. Fishponds are a common feature. Various fish are fed with vegetable and human waste. (Michon, Bompard, Hucketsweiler & Ducatillion, 1983)

Fig. 29: *Livestock is an important component of agrororestry.*

The villagers themselves are part of the agro-system. Their knowledge, experience and practices regulate or modify the functioning and the dynamics of the other biotic components. They extend "individual care" to each plant that could be compared to the "mass treatment" attitude towards cultivated plants in monoculture.

The villagers themselves simulate these general patterns of the natural forests development by *chablis:* forest regeneration and succession. In the agroforest, annual crops are harvested at the end of their productive season whereas trees

are eliminated as soon as their productivity is decaying. A fallen tree produces a gap in the agroforest vegetation which is similar to a forest *chablis*. However, villagers control the fall of the tree and so the gap is not as large as in a natural *chablis*. The recolonization of this *chablis* is partly controlled by the villagers. The wood of the fallen tree is first collected, so that the open space is free of debris. It is sometimes kept clear for vegetables growing for one or two years, allowing a better control of weeds. Next it is planted with cultivated 'pioneer' species such as the banana (wild) or Leguminosae (*Albizzi faloataria, Parkia sp*). In this way, the villager starts a process of regeneration by including or controlling the different succession phases: Under the thin foliage of the leguminosae he will plant half-shade species for the next successional stage (fruit trees or others), then shade species for further stages, thus restoring the disturbed agroforest. Each successional stage induces a physical environment (i.e. competition for light and soil resources) that will allow the next stage to be established, and may be furthermore, characterised by its composition in plant species and by the spatial arrangement of the crops. Besides the natural cycling process, a recyling system of waste products has been established. The mud of fishponds, composted with kitchen waste, is distributed as an additional fertilizer on vegetable beds or on commercial crops; green fertilizers (uprooted "weeds' or leaves of leguminosae) are also commonly used. Leguminosae are widely grown to improve the soil quality. These cycling and recyling systems are sufficient to maintain soil fertility with no resort to chemical fertilizers (Michon, Bompard, Hecketsweiller and Ducatillion, 1983). Such gardens (as above) provide the farmer with a mix of food and cash crops that can offer a large degree of self-sufficiency. Harvests and consequent income are dispersed throughout the year and provide greater stability than is possible with only one or two annual crops.

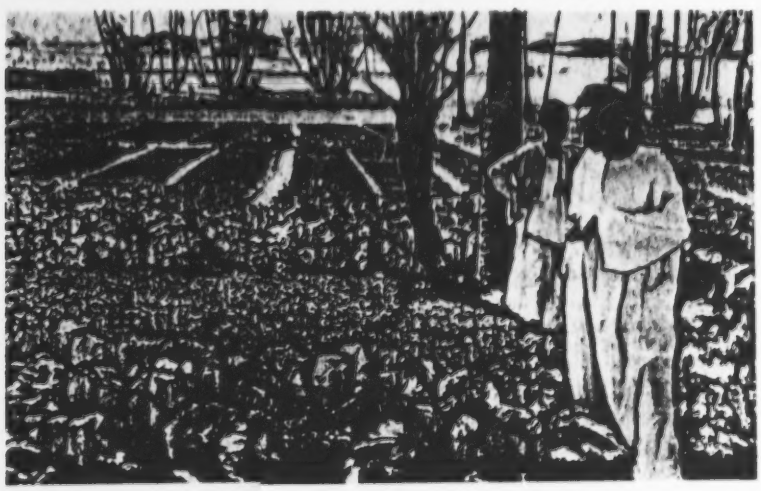

Fig. 30: *Vegetable growing in the Sahel region.*

10.4.3. **Agroforestry Practice in Africa**

Agroforestry started long before modern farming whose methods often include large scale land clearing and the growing of single crops, often with large inputs of fertilizer and irrigation.

In semi-arid zones, for example in the Sudan and Sahelian zones of West Africa *Acacia albida* and *Pakia clappertonians* are grown as farm trees. These provide food and fodder for cattle and at the same time bring additional source of income to the farmers through the sale of their firewood.

In Tanzania indigenous farmers intercrop coffee, bananas, and annual crops with timber trees such as *Grevillea robusta* along the slopes of mount Kilimanjaro. A combination of agriculture, animal husbandry and forestry, is practised by local farming communities in Southern Senegal. Borassus (palmrya), *Adansonia digitata* and *Acacia albida* are the species most valued for their multiple domestic and industrial uses. These crops are cultivated together with millet, sorghum and groundnut in stands for livestock to browse (Niang, 1980).

In Zimbabwe, agroforestry had its origin in the "Chiteme" system of growing food crops. This is where a small area of woodland is cut down, cleared, stacked and burnt. The ash is then spread and sown with annual crops (such as maize.) After a few seasons the fertility of the soil gets less and the cultivator moves on to another site, leaving the woodland to grow again, if it can. Modern agroforests are grown from "Chiteme", or if trees had been deliberately planted (e.g. mango) or the regrowth had been encouraged—not left to chance.

The success of "Chiteme" depended upon a long period of fallow (resting for 20-40 years). During this time the trees were able to grow again and thereby the fertility of the soil was restored to a level where it could once again support food crops for a few years. However, because of the ever increasing population, the fallow period had to be shortened; the people were forced to return to grow a food-crop before the fertility of the soil was fully restored. Unfortunately, in Zimbabwe, the fragile soil cannot stand up to such harsh treatment and the fertility of the soil declined leading to lower food-crop yields and little or no regrowth of trees. The vicious cycle—more people needing more land for growing food crops—often led to large scale soil erosion. In the arid and semi-arid areas of Zimbabwe this would lead eventually to the creation of desert.

In the Ivory Coast, a kind of farm forestry practice is undertaken. Here, oil palm is grown in association with other cash or industrial crops, such as Hevea, coffee and cocoa. The palm groves provide suitable habitats for cattle raising. A combination of agriculture, animal husbandry and forestry is practised by farming communities in Southern Sudan. Tree species such as *Borassus*, *Adansonia digitata* and *Acacia albida* are cultivated together with millet, sorghum and groundnuts or in stands for livestock to browse (Niang, 1980).

In Sierra Leone, a land of *taungyan system* has been tried using understorey of cash crops such as cocoa and coffee in Terminalia plantations in protected forests. The practice has been more on experimental basis with selected farmers being allowed to plant or lend coffee or cocoa or both within the plantation as long as terminalia trees were not destroyed. Experimental plots were established at Kase-

we and Kambui Hills Forest Reserve. The cocoa or coffee were expected to bring quick monetary returns (to the farmer) as minor forest products. The farmers were allowed to continue harvesting the cash crops and clearing the plantation until the terminalia was matured, which was usually around 35 years (Mansaray, 1983). The experiment has now been virtually abandoned due to retirements, resignations, transfers, etc. (Koroma 1983,) of the investigator staff involved.

Taungya Farming Systems embrace multiple land-use practises involving joint production of forestry and agricultural crops. In the tropics, land is a most important factor of production, and there is overwhelming dependence of the population on land for livelihood. The introduction of taungya has alleviated the problems created by the wasteful use of land under the traditional agricultural production systems, increased food supplies, and significantly contributed to the socio-economic well-being of the rural populations.

The introduction of the taungya system into the humid tropics was a response to various socio-economic factors. For example, in Nigeria, a major objective was to solve the problem of the high cost of forest regeneration. In Ghana, the objective was to solve the existing land hunger problems in the rural areas.

Whatever the reasons for introducing *taungya*, the successful establishment and development of taungya depended on the pre-existence of land hunger, under-employment, and low standards of living among the rural communities.
Apart from these three pre-requisites, other socio-economic factors contributing to the development of taungya include population growth, land availability, farm labour supply, food supply, income-generating potential, availability of infrastructural facilities (e.g. transport, marketing and storage facilities) and organizational institutions.

There are more advanced agroforestry systems/techniques which are being tried by various International bodies or institutions such as the international Institute of Tropical Agriculture (IITA) in Nigeria, the University of Hawaii, USA and the International Council forResearch in Agroforestry (ICRAF) Kenya, including other institutions elsewhere. These are improvements on the traditional method and other methods (practised in Africa) considered earlier. The goals or aims of these modern methods are much more clearly defined. The system incorporates agricultural crops and forest plants, fast growing tree crops and animals simultaneously or sequentially. The main aims are to check erosion, build up soil organic matter and recycle nutrients. The fast growing trees may be chopped back for timber which may be sold to augment the farmer's income.

One modified example of the above system tried and evaluated at IITA is *alley-cropping* (IITA Annual Report, 1980). In practice the system involves planting fast growing trees such as *Leucaena* or *Gliricidia* and later cutting them back. The leaves so removed are applied to the soil as mulch and nutrient source, and the branches are used on succeeding crop. The mulch provided an equivalent of 100 $Kgnha^{-1}$ to sustain maize production on a low fertility soil (IITA Annual Report, 1980). Alley cropping offers an attractive alternative to the bush-fallow and may be easily adopted by small farmers in the tropics. Another form of agro-forestry practised, tried and evaluated by the International Council for Research in

Agroforestry (ICRAF) is a combination of rangeland management and agroforestry known as *sylvo-pastoral system*. The system which involves the use of browse shrubs and fodder trees is now seen as a key way of supplementing animal feed. Woody perennials in grasslands may reduce grass production but not the overall production of total fodder or protein. In addition, the phenological responses of trees and shrubs can be different, sometimes very different, from that of the ground vegetation. Hence these trees/shrubs can extend the supply of available feed materials into unfavourable seasons in a very significant way (Huxley, 1981)

10.5. AGROFORESTRY AND PROBLEMS OF DEVELOPMENT

10.5.1. Agricultural Problems

These are basically problems of food production. They pertain inter alia, to low soil fertility, low crop yield, seasonal shortages of fodder and water supply for livestock, poor crop storage quality and capacity, inadequate food processing facilities, water supply and irrigation, and pests and diseases of farm animals, crops and trees.

Left largely to practise the age -old system of shifting cultivation, the rural farmers cannot cope with the demands of a growing population for increased food production. They adjusted their methods by increasing the areas under cultivation: a move which initially brought more virgin forests under the axe. Later, however, it became imperative to shorten the fallow period when no more virgin forest was available. As this process continued, the critical period for soil regeneration could no longer be maintained and rapid soil exhaustion led to poor crop yields.

The need for a shift from extensive to intensive land use was felt but could apparently not be satisfied because the strategy proposed for its fulfilment was, for the average farmer, rather expensive i.e. the use of imported chemical fertilizers improved seed and new germ plasm; water control and irrigation which overcame the limitations of seasonal production.

Thus the initial poverty which denied the rural farmer the opportunity to improve his productive capacity was aggravated by the consequences of his failure to produce more. As a result, the collective capacity of the rural areas to meet the challenge of food production has been eroded. The first sign of such an erosion is the continuing outmigration of young, able-bodied men to the urban centres, leaving only the women and the older men to shoulder the bulk of the farm production effort. No amount of exhortation or agricultural education in the formal school system has so far been effective in motivating the young to return to the conditions they had left in the rural areas. These young people could observe, on periodic visits to their villages, the progressive worsening of the fortunes of their elders as they try, often in vain, to squeeze something more of a yield out of a wasting land.

The hope now is that agroforestry practices can arrest and reverse this growing destruction. Then the agricultural problems would be largely solved. The trees would bind the soil to retain more water from the rain or irrigation the field crops would find shade under the green belt and increase their yield. The animals would find better grazing and browsing and obtain fodder during the dry season,

hence grow faster and yield more animal products. One could go on with the various possibilities of improved production under agroforestry systems. But the point is made that even with the limited inputs into the production process as at present, agricultural output and profitability would be enhanced and that would be a better inducement than exhortations to the youths to return to the land.

The sort of evidence that the young people would require has been out in the Lagos Plan of Action as the need for "A self-supported development and economic growth founded upon the principle of collective autonomy and seeking to improve the standard of living of the great mass of the African population and to reduce excessive unemployment."

This same Plan of Action has called for detailed surveys of land forms, soils and water supplies to aid planning. This implies training of "rural surveyors and hydrologists" or the establishment of "terms or rural engineers". The aim is to develop alternative land use and management systems to check shifting cultivation and make the farmers an integral part of rural development programmes. It is clear, therefore, that the issues have been stated in terms of socio-economic development, especially in terms of reduction of economic dependency. Thus we have issues such as collective economic autonomy i.e.

—development and exploitation of resources (grasslands, swamps, rivers, lakes, oceans) to satisfy basic needs of rural populations,
—provision of work or job opportunities for more people.

Problems of applying agroforestry to rural development

A major problem is one of uncertainty. Agroforestry is not a systematic traditional science discipline with its own body of process, methods and facts to be readily applied in specific situations.

It is becoming a branch of science and technology, that necessarily uses the stock-in-trade of agriculture, forestry and ecology, etc. It could well turn out to be merely an approach and not a well-defined, separate, discipline.

The basic research job is still to be done to discover compatible combinations of species of crops, perennials and animals that could give maximum sustainable yields.

One thing is clear. For agroforestry, larger units of land are required than for agriculture or forest development separately. But this can be a problem only in areas where available land is limited.

The fact that agroforestry had for so long been ignored by both agriculturists and foresters means that knowledge and experience are greatly limited among these who practise it. It also means that even those who have sufficient relevant experience and knowledge to advise farmers and train others are few. Thus leadership in agroforestry is severely limited and hard to come by.

The problem of change may be the biggest in the end. Rural communities tend to be very conservative and highly resistent to suggestions for changing their patterns of living and working. They quickly sense the risks involved and, unless the gains are really obvious and substantial they will not take the risk.

This brings up another problem—that of management. Any programme and/or projects designed to promote agroforestry must have good managers, otherwise they will not succeed. Management has been the biggest problem in African development, especially in agricultural development programmes.

There is also the problem of deciding how much land to allocate to agroforestry in constrast to agriculture or forestry. This is basically a resource allocation problem which will have to be solved on the basis of comparative returns on the investment.

There is the need to learn in detail how and why the rural populations use particular lands for agriculture. This could be the start of their participation in any scheme to introduce agroforestry to them. They have learned by long experience to assess the agricultural potential of their local soils and water resources. Thus they are able to tell which soil will support which crop profitably at a given time. This store of information should be built up and upon.

10.3.2. **Environmental Problems of Rural Development**

There is a wide range of environmental problems which have beset the rural populations over the years. Apart from the usual trouble with pests and the more intractable problems arising from drought and desertification, now spreading over a considerable part of the African continent where 44% of land is affected, these problems cannot, apparently, be halted despite almost two decades of sounding warnings and alarms.

These problems, arising from human activity, should not be beyond our ability to resolve. Yet they continue to threaten the very existence of rural communities and, hence, of the nations themselves; for 80 per cent of the population of African countries live in the rural areas. As the pressure of growing human population increases, the problems of environmental protection and conservation seem to recede in the scale of priorities. Or it may well be practically abandoned. Thus the environmental problems persist: the nutrient poor soils, the massive erosions and seasonal pollution of rivers and seas with heavy discharge of silt, the overgrazing of limited and poorly managed pastures: all continue to spell neglect of rural communities in bold capitals.

Some of these problems differ somewhat according to the ecological areas, especially in the aspects of the physical and social environments.

(a) The Humid Tropics
(b) The African Highlands
(c) The Semi-arid and Arid Zones.

(a) In the humid tropics rainfall is not much of a problem and water availability depends merely on the access to a stream or public faucet. The rural environment is plagued with leached soils, eroded hillsides, and denuded forests. Here livestock raising is best with pest and parasite infestation. Flooding and weed control could create problems.

(b) In the highlands rich soils provide pine forests but water may be short. Livestock thrive best. The problems of harvest losses are less than in the humid tropics.

(c) In the Sahelian and desert areas the environment is harshest. Prolonged drought devastates vast areas as livestock perish when they cannot be driven by nomadic pastoralists to more humid and greener pastures.

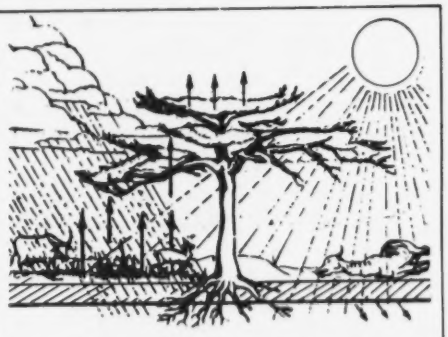

Fig. 31: *Prolonged drought devastates vast areas in the Sahelian and desert areas.*

This is essentially savannah land merging into pure desert. So trees are sparse and tree growing is not part of the customs of the people. Yet trees are needed as a belt of vegetation to protect man and beast from excessive sunshine, dust or storms and provide fuel and useful timber.

10.3.3. **The Human Environment**

The human environment into which agroforestry programmes are to be introduced is characterized by a serious imbalance which must be taken into account at all levels of development planning. The important role of rural women in agriculture, especially in food production, has been documented.

Although women in rural areas produce most of the food for home consumption (in some countries up to 90 per cent) they have only inferior social status and are left out of the agricultural development planning. As a result many projects fail which would otherwise have succeeded. This point is important for planning agroforestry programmes. Indeed, Mary Rood-Kowsky, writing in a recent FAO Information Note on *Women in Agriculture*, has pointed out that international and private development agencies, governments and community groups, have made support for women in development a top priority".

Fig. 32: *Women play an important role in agriculture and trade.*

Planning has to take into account the women's contribution in all aspects of farming, from bush clearing to harvesting, storing and processing of crops. Eighty per cent of the labour force in trade in West Africa also are women. Now since the social patterns generally favour men,

It is important for changes to be made to permit women to go on with their rolls when land reforms are being carried out or when new and lucrative measures are being introduced into farming or agroforestry. Agroforestry practices could suit women equally as men. Therefore the introduction of agroforestry should include the training of women for appropriate roles, while allowing for their roles as parents or home makers. In this regard, it is important to stress that by improving the income-earning potential of rural women, the overall development of the rural areas would be accelerated. There are many convincing examples of this.

10.6. SOCIAL, ECONOMIC AND POLITICAL PROBLEMS

10.6.1. Socio-economic Aspects.

The high cost of forest regeneration was one of the major factors that influenced the introduction of agroforestry in Nigeria [6]. There are also the high development costs of converting bush to paddies all of which reduce, if not eliminate, the profitability of farming. Agroforestry can significantly promote cultivation without the need for large-scale construction works e.g. dykes, drains, etc. The lack of technical inputs (credit, tools, improved seeds, fertilizers) and infrastructural development, can be relieved to some extent by removal of the need for some of them e.g. chemical fertilizers. But in time, as successful agroforestry practice improve the income-generating potential of the rural areas, such inputs will be made from internal sources through the growth and development of appropriate cooperative institutions.

Until now, the income generating ability of the rural farmers has been kept low by governments pegging down the prices of farm produce to relieve the burden on the urban poor. Yet the urban poor consist largely of migrants from the rural areas who have been attracted by the development of the urban centres financed by the surplus from agricultural earnings.

The introduction of agroforestry would provide an opportunity for this trend to be reversed and for greater inputs to be made into the rural areas to boost production. This means capital, trained manpower, technology and good management potential. Such a move will favour the establishment in the rural areas of agro-based industries that will promote the diversification of the rural economy. It would also facilitate reverse migration to the areas and relieve the farmers of worry over shortage of farm labour.

Energy and power supply problems could be eased if suitable fuel wood species are used in the agroforestry systems.

10.6.2. Social Aspects

Large-scale unemployment and out migration from the rural areas tend to disrupt the social organisation of the rural areas. This happens through the creation of imbalances in the social structure as most of the young adults move away. The problem is compounded by the lack of social amenities and often of basic human needs.

The abject poverty in some areas compel rural populations to aggravate environmental problems of deforestation and the consequent erosion and loss of soil fertility, sometimes irreversibly.

Fast growing trees like *Gmelina* and *Acacia albdia* can be used to provide fuel and rehabilitate the agricultural lands.

The social conditions in the rural areas reflect their neglect over the years. The picture is most vivid when seen in the women and children, no matter which of the various communities is in focus.

Fig. 33: *Young adults migrate from rural areas to the cities.*

Rural communities consist usually of small farm holders, tenant farmers, share croppers, land labourers, small holders, artisans or artisanal fishermen and boat builders: landless poor.

Agroforestry can help promote rehabilitation of the rural areas, fast deteriorating everywhere. Apart from improved crop production, the trees would provide a variety of products for all the communities. Rural communities are not homogeneous, even within the same ecological zone. Maydell has distinguished three categories as;

(a) Urban societies and associated village centres, which require primarily firewood, charcoal, construction timber and a green belt to protect settlements against dust storms and to provide shade and amenities.

(b) Rural sedentary societies, practising mainly dry farming and requiring firewood, construction timber, fodder, edible leaves and fruit, gums and other natural chemical products for subsistence and commercial uses: green belt to protect field crops and improve soil and water balance; and provide food supplements during dry season.

(c) Rural migratory societies mostly nomadic pastoralists needing fodder from woody plants in dry season.

But these multiple demands have not been fully quantified, therefore, accurate assessments of appropriate production are still in the future. This is particularly true because of community preferences for tree and crop species which may not be the most productive among possible choices.

10.6.3. **Cultural Aspects**

Such preferences lead us to the cultural aspects of rural development. These may show up in several other ways. But on the whole, they reflect the determination of rural populations to preserve and promote their own cultures. This has been identified as a right to cultural difference. Indeed, modern trends in development

smack of cultural assimilation; and rural peoples react to this quite often in subtle ways interpreted usually by others as resistance to change or progress.

They might prefer the old seed to an improved variety from elsewhere because they find the new crop less palatable. They might prefer their slow-growing trees or shrubs to demonstrably faster growing ones from abroad because they require the medicinal products from bark or roots and so on.

Agroforestry has a role to play here, both in permitting the preservation of local cultural values, and in promoting the adoption of external mechanisms which would enhance the likelihood of achieving the declared goals of rural development projects.

10.6.4. **Political Aspects**

The problems we have been discussing in reality concern the rural poor, the eradication of whose poverty is the avowed goal of all rural development programmes. However, there appears to have been a lack of political will or resolution to embark on what is essentially a national development with the determination and vigour that it deserves. Because anything from 60 to 80 per cent of the population normally lives in the rural areas of most African countries and rural economies contribute 40-60 per cent of the GNP , the distribution of national development efforts and national wealth between rural and urban areas would appear to be inequitable.

This need for equality relates to a shift in development emphasis to the rural areas. It also relates to questions of greater economic and political power for the rural peoples. The United Nations Research Institute for Social Development recently confirmed that in some countries there is a tendency for high land prices and increase in average size of land to generate growing numbers of landless peasants. We can recall that one device suggested at the Nairobi Conference on Rural Development in Africa was limitation of the size of private land holdings.

Other areas for political action include the wanted allocation of good agricultural land to agriculture, leaving the poorest lands for agroforestry. There might be a need for legislative authority here to allocate better lands for agroforestry. Equally, also similar remedies might be prescribed for pricing policies to induce increased productivity.

Fig. 34: *Somalian refugee with starving children.*

Political action is needed also to increase investments in rural development, especially through agroforestry systems for food production, timber and fuel wood supply, and so on. In addition, where food shortages are aggravated by civil strife and heavy refugee burdens there is clear need for

political solutions. As the drought persists, three is also a growing tendency to depend on food aid, with its own accompanying political problems. Yet the desired political action once taken can pave the way for the right technical, financial and human inputs to be made into rural development, hence into food production and distribution to obviate the need for food aid which, as Crawley observes, only increases a country's dependency of foreign aid. According to a recent FAO report, about 30 countries have pledged food aid of 2.3 million tons of cereal to African countries as of March 1984 in response to Dr. Saouma's call for help to meet the need, estimated at 5.4 million tons of food.

10.7. APPLICABILITY OF AGROFORESTRY SYSTEMS

In order to determine by objective analysis what Agroforestry can and cannot offer and to build up the scientific credibility of the discipline and provide a useful instrument for those who want to promote agroforestry practices, researchers should compare the potential of agroforestry with that of monocultures. Such comparison must carefully weigh the advantages and disadvantages of each system from biological and social-economic perspectives.

In order to justify its use, the practice of agroforestry must equal or better the performance of any alternatives, notably monocultures. It should be judged according to both economic and social, short and, long-term aspirations, depending on the feeding requirements and land use patterns, the areas devoted to agroforestry can cover a small or a large part of the land used by rural communities.

The following is a list, with emphasis on the humid tropics of agroforestry practices as compared with monocultures, which has been compiled from several studies.:-

10.7.1. Biological Aspects

(a) Advantages

- A larger amount of solar energy is captured;
- A better utilization of the vertical space is achieved and up to a point, natural ecological models are simulated as
- There is greater resistance against adverse rainfall conditions (both excess rainfall and unseasonal droughts);
- Temperature extremes are mitigated (lower maxima and higher minimal), benefits particularly affecting plants and animals close to the ground; the lower maxima reduce the speed of decomposition of organic matter;
- The damage caused by strong winds and raindrops with high energy is reduced;
- A larger amount of biomass returns to the soil as organic matter through fallen leaves, fruits, flowers, and branches. There is greater efficiency in recycling nutrients because tree roots capture nutrients that move through the soil profile or to areas far away from the annual or perennial crop plants; in this connection the long, superficial horizontal roots of trees may play an extremely useful role, as was pointed out by Lundegren (16): "the superficial root system (of trees) will reduce nutrient and soil losses by leaching erosion and improve porosity, infiltration and aeration pro-

perties, and their deeper roots will bring up nutrients from depths to be incorporated into the biomass."

- Trees and their roots tend to improve the soil structure by producing a higher amount of stable aggregates and avoiding (also dismantling) various types of hard pans; percolation is thus favoured and there will be less stagnant water on the soil surface;
- There will be less proliferation of weeds because less light reaches the ground and there is the possible suppressive effect of mulching;
- Mulch production,—particularly if trees are pruned or pollarded, reduces water evaporation from soil, adds considerable organic matter, and reduces (or eliminates) the need for tillage;
- Most trees are better able to extract available nutrients from the soil through the activities of mycorrhizae. In the case of most legumes (and representatives of a few other families), nitrogen form the air can be fixed through the action of specialized bacteria and other microorganisms and incorporated in the plant tissues;
- Manipulation of the arboreal strata through pruning (particularly) to control crown density) can become a tool of better control of phenological processes like flowing or fruiting, for the benefit of associated plants; moreover, the trees themselves can be selected for appropriate phenology (17), particularly their deciduousness (18).
- A greater diversity of fauna is promoted because trees provide a variety of niches for animals (a source of protein),
- Birds, and other beneficial predators of harmful insects or rodents;
- The diversity of plant species and their spatial arrangement can deter insect proliferation; and
- Trees may serve as supports for climbers of economic value (19).

(b) Disadvantages

- Trees compete for light with associated plants in the lower strata, and thus lower the yields and the quality of crop plants;
- Trees may compete for space with associated plants, both above and below ground, and this competition can be a handicap for either or both oomponents;
- Trees compete for nutrients, store them in stems and branches, and hence make them inaccessible to associated crops;
- There is a loss of nutrients when the wood is harvested or "exported" from the area; this is, of course, equally true when fruits or seeds from the trees are harvested;
- Trees compete for water in the soil in times of water stress, the more so if they keep their leaves and (transpire) instead of shedding them;
- Trees keep part of the rain in their crowns; this fact can be important when there are light rains; stemflow can adversely redistribute rainfall;
- The harvesting of trees may cause mechanical damage to the associated crops;
- Mechanization becomes more difficult or impossible;
- Micro-relief manipulation of the soil surface (furrowing, building of

mounds, etc.) to benefit certain crops is more difficult or impossible;
- Air moisture close to the associated crops may be increased (partly because of less air movement), favouring fungal diseases;
- Large water drops that coalesce and drop from the higher parts of the tree crowns may cause damage to the associated crops (for instance, in times of flowering);
- The different environment produced by the addition of trees can favour the proliferation of noxious animals; and
- Some trees have allelopathic (i.e. causing sterility) effects on crops.

10.7.2. **Economic and Social Aspects**

(*a*) *Advantages*
- Farmers obtain, at least in part, direct economic benefits from the tree that satisfy their needs for firewood, posts, poles, sawn wood, certain fruits, feed for cattle, flowers for honey, medicinal products, etc. they do not need to buy these products or transport them from far away;
- Trees that produce saleable wood constitute "standing capital" an insurance against emergencies in case of immediate cash needs;
- Dependency and catastrophes associated with a single crop are overcome or mitigated, particularly in the case of irregular rainfall patterns, market fluctuations, pest outbreaks, difficulty in acquiring imported products such as pesticides, fertilizers, machinery and spare parts, concentrates for cattle, etc. Moreover, the price of such imported products may (and often does; drastically increase;
- The economic investments required to establish tree crops may considerably be reduced because of the benefits obtained from annual crops at the early stages of tree growth; in some cases the number of years devoted to annual crops can be increased if thinning, pruning, or upper crown manipulation is undertaken, and additional economic benefits can be obtained (posts, firewood) at the early stages of tree development;
- The presence of trees usually reduces weeding costs; trees can be used to mark property boundaries and constitute a safeguard against land usurpation;
- There is more flexibility to distribute the work load during the course of the year;
- Wildlife can be favoured and may be harvested for protein;
- Some schemes allow a gradual change from destructive land-use practices towards more stable systems without diminishing productivity; and
- There is obviously considerable scope to improve on existing stable systems and to design new systems with higher production and productivity by associations of the most desirable plant species (and animals), in space and in time, by drawing on local and worldwide experience.

(*b*) *Disadvantages*
- In some cases, over the same area, yields of crops (or pastures) can be lower than for ponocultures; even if the combined value of crops and trees is higher, it may take a number of years for the trees to acquire economic value;

- More manual labour may be required, a negative factor where labour is scarce and expensive and mechanization appears to be a better alternative;
- Agroforestry is often associated with land-use systems of poor people, where little effort is made to adapt improved agronomic practices such as selection of improved varieties or use of fertilizers, and there is usually a complete neglect of pest control; in this connection, it is often argued that many current agroforestry practices do not stimulate farmers to abandon their present socio-economic status associated with poverty and subsistence levels;
- In depressed areas, economic recuperation may take a longer time (than with profitable cash crops) because of the time lag in cropping trees; .
- In areas of high population density and scarce land resources, where survival is based on the next crop, there may be considerable resistance against the planting or tending of trees. The particular case of taungya, when cheap labour is used to establish trees with the collaboration of itinerant farmers that do not own the land, may be considered socially inadequate or a vestige of colonial or other practices linked with exploitation of the poor;
- There is considerable scarcity of trained personnel to handle or improve existing agroforestry systems, devise new systems, and install demonstration plots;
- Agroforestry is more complex and less understood by scientists, extensionists, or farmers with a higher agricultural education. Also any experimental designs involving complex associations (in space or in time) and subject to statistical analysis are likely to be so difficult that they can hardly be done in existing plots because of the impossibility of controlling, let alone manipulating, the variables. Testing agroforestry practices and comparing them with monocultures may thus become a lengthy, difficult, and costly task which can only be carried out efficiently by selected experimental stations where adequate land, funds, and specialists of different disciplines are available ; and
- There is a lack of knowledge among decision – makers about the potentialities of agroforestry and this results in a lack of funds for land-use planning, research, and extension programmes; backlashes resulting from false promises (e.g. "miracle" trees) may compound this rather depressing picture.

10.8 AGROFORESTRY IN THE ENVIRONMENTAL EDUCATION CURRICULUM

For rural development to be truly effective and permanent, the education required is a mass education of the whole rural population. This invites people's participation in meaningful way in all "the institutions and systems which govern their lives Thomas Jefferson has been quoted as saying: "Enlighten the people generally, and tyranny and oppression of body and mind will vanish like evil spirits at the dawn of day."

So the required education should include pre-school, primary and adult education and training, backed by extension services and other technical inputs into the rural economics. Peoples's participation should involve exchange of information on

agroforestry practices with technical experts in forestry and agriculture, as well as with community development workers. Participation should not be confined to carrying out decisions taken elsewhere by others, but should extend to planning and designing programmes and policies; establishment and running of organizations and institutions for rural development, especially for the promotion of agroforestry in their communities.

10.8.1. **Goals and Objectives of Instruction**

1. The *main goal* of Agroforestry in the Environmental Education Curriculum is to produce informed and trained citizens who can ensure the successful introduction and maintenance of effective agroforestry in farming and land management systems for the development of the rural areas.
   A comprehensive education and training programme for the environment education of the people would include at least four levels of target groups:-
   (a) Adult Educator, and Trainers of Field Workers
   (b) Field Workers including Extension Workers, etc.
   (c) FARMERS and other Rural Workers.
   (d) The COMMUNITY through Adult Education and Mass Education Programme.
2. General Objectives of Instruction should:
   (a) Provide basic general and scientific education for the rural population to enhance their capacity to absorb and apply new ideas and technologies in rural development;
   (b) raise the levels of adult education in agriculture, forestry, animal husbandry, and the dynamics of rural development;
   (c) provide specific education on agroforestry practices and applications in various ecological zones;
   (d) provide suitable learning and working environments for developing skills in agroforestry and community development;
   (e) focus specially on the education and training of women for full integration into the political and economic structure of the rural areas:
   (f) sensitize planners, decision-makers, development agents, extension workers and farmers to the potentialities of agroforestry for rural development:
   (g) generate public concern for environmental protection and natural resources conservation especially in those people involved in rural development.
3. *Specific Objectives* of Instruction would depend on the education and training of Adult Educators and Trainers of Extension Personnel, for example, the following objectives would seem appropriate:-

   (a) To provide learning experiences which will enable the Adult Educator/ Trainer acquire *knowledge* of the theory and practice of agroforestry, *specific skills* related to the practical aspects of agroforestry, *information* and *altitudes* pertaining to the conservation and protection of the enviroment which they should be able to pass on to the field workers in agroforestry;

(b) To teach Adult Educators/Trainers the fundamentals of relevant basic and applied sciences (e.g. Biology, Agriculture, Forestry, appropriate technology, etc.) to enable them grasp essential scientific ideas and principles which are required for effective scientific farming;

(c) To provide background knowledge and information which will facilitate the work of the Adult Educator/Trainer through complemen - tary courses in the following related areas:-

(i) Fundamentals of Rural Development
(ii) Some basic concepts of food production
(iii) Management and organisation at all levels of agroforestry systems.
(iv) Accurate data collection, storage, retrieval and analysis.
(v) Introduction to systems analysis as applied to agroforestry as a system of land-use cum resource management; and agroforestry as a food and tree product production system
(vi) Project design, development, implementation and evaluation.

4. *Strategies for reaching the Objectives of Agroforestry through Community Adult Education*

The complexities of Agroforestry systems demand educational strategies that are based on the problem focal points, or generative needs of communities. Therefore, their programme activities should be oriented towards initiatives and self-reliance, and should be based upon popular participation. All the components of an agroforestry system should be examined under set criteria and programme activities:

(i) *Participation:* involve men, women and youths in the design, development, ownership and control of programmes, products and processes.

(ii) *Anticipatory:* have goals of long range effects which are geared to the welfare of future generations, e.g. environmental protection.

(iii) *Holistic:* integrate culture, economy, ecology and appropriate technology in the design criteria.

(vi) *Location Specific* make use of local materials and local skills to solve locally identified problems within local cultures, ecologies and economies.

These strategies call for co-ordinated action on the part of Ministries and Agencies. Co-ordination should be centred around the problems and needs of communities and *not* on Agency functions; and hence Agroforestry projects should:-

(a) involve participants in the analysis of the problem at hand;
(b) regulate the rhythms, pace and progress of activities to suit the needs of the community and the nature of their activities;
(c) create a local structure for participation and decison-making;
(d) identify the use and development of local resources;
(e) stimulate members of the community to be educators and multiplying agents.

10.8.2. **Note on Methodology**

Educational Methods are developed on the basis of educational objectives and the problem of the community which take various forms. They go beyond single teaching/learning approaches, and should combine the following:-

- DEMONSTRATION —to show how to use a procedure or perform an act.
- GROUP DYNAMICS —to discuss a topic of natural interest and pool the knowledge, abilities and experiences of the group in an attempt to reach a common understanding or goal.
- LECTURES —to present factual information on a specific point of view, on a controversal subject which may entertain, inspire or stimulate the audience.
- AUDIO-VISUAL SHOWS—to introduce topics to learners

1. *Scientific Farming Through Agroforestry*:—
   (a) Elementary Biology, basic ecology, including forest ecology.
   (b) Soil and land types and carrying capacity.
   (c) Plants and Animals of economic importance to the area.
   (d) Concept of ecosystem
   (e) Principles of agronomy, agronomic practices; shaded plants, mulching, compositing, etc. water cycle, climate and elementary animals husbandry.
   (f) Elementary Farm and Forest Management including
      (a) Estimation of profit and loss
      (b) Storage, marketing and distribution
   (g) Food Production in relation to population
   (h) Population growth, land carrying capacity
   (i) Nutrition, malnutrition, starvation
   (j) Balanced feeding, child care.

2. *Fundamentals of Rural Development*
   Ideas, objectives, strategies, main factors, relationship with national development, preferred local strategies, including:-
   (a) Basic concepts of rural community structure, organisation, development and the main actors.
   (b) Cultural basis for rural development.
   (c) Women in rural development.
   (d) Basic social amenities for rural development, e.g. good housing, adequate food and fuel supply, recreational facilities, transportation, markets, good water supply, health and education facilities.
   (e) Basic conditions for rural development: eradication of the manifestations of poverty, fostering economic growth, controlled population growth, equity in distribution of economic gains and political power; environmental protection and resource conservation; human resource development and local participation in development process.
   (f) Basic strategies such as practical demonstrations of successful (and

profitable) agroforestry systems; mobilization of resources for increased investment, expansion of production and employment; introduction of technical innovations, increase in efficiency of resource utilization; integration of "urban and rural areas into mutually supporting networks of production and exchange" diversification of rural economies.

3. *Nature and Scope of Agroforestry*

What Agroforestry is, and a comparative study of agroforestry systems in Africa.

(a) The advantages, limitations and disadvantages of agroforestry systems compared with:
   (i) traditional farming systems
   (ii) modern monoculture systems
   (iii) forestry practices
   (iv) livestock raising and ranching
(b) Characteristics of various tree crops and livestock combinations;
(c) Agroforestry and ecological systems: tropical rain forests, Sahel savannah, Guinea savannah, etc.
(d) Management of agroforestry systems.

4. *Women in Rural Development*

The role of women in local agriculture and food production; women in agroforestry systems; women's work load and patterns of work; contribution of women to domestic economies; education for, and of, rural women; women's organisations and collective economic security; family planning and population control.

Fig. 35: *Women contribute heavily to the domestic economies.*

5. *The Role of culture in Basic Needs Provision and Collective Development*

(a) The concept of culture, the cultural basis of rural development strategies and projects; the cultural aspects of agriculture; adult education.
(b) The concept of peasant rationality and modern approaches to rural development.
(c) The concept of social change, acculturation, cultural grievance, cultural integrity.

6. *Practical Techniques for stimulating Community awareness and participation*

(a) Demonstration 'farm forests', national or village publicity campaigns for public information by radio, press, posters, exhibitions.

(b) Materials development (including application to literacy materials), especially in local languages.
(c) Provision of incentives to prospective participants in local agroforestry projects.
(d) Spread of agroforestry ideas in schools and teacher training institutions.
(e) Appropriate training of extension workers in agroforestry methods and techniques.
(f) Proper management of agroforestry systems and training of managers for all levels.

7. *Research into agroforestry systems*
(a) Methods of data collection, recording, storage, analysis and interpretation (farmers and extension workers to be involved in such data collecion)
(b) Needs assessment methods.
(c) Experimental trials of new tree-crop-animal combinations.
(d) Utilization and evaluation of available research results.
(e) The place and location of types of research: basic, participatory, anthropological
(f) The use of feedback.
(g) Possible areas of research:-
(i) Biological and ecological
(ii) Socio-economic
(iii) Socio-cultural
(iv) Impact of adoption of agroforestry practices.

8. *Additional Resources*
(a) Materials for Adult Education in agroforestry could include modules developed locally or elsewhere, audio-visual aids, models reference books, pamphlets, journals, etc.
(b) Agricultural tools and implements
(c) Improved seeds and seedlings.
(d) Water supplies.
(e) Instructional materials and supplies
(f) Extension and advisory services
(g) Farmer training schemes/support services e.g. research institutes, universities and academics.
(h) Availability of new species of trees/plant, fish, livestock.

10.9. RELEVANT RESEARCH IN AGROFORESTRY

10.9 1. Inventory and Application

Inventory and application of available research results would seem the logical starting point. There is ample evidence of successful agroforestry systems in a number of countries from which a start could be made; for instance, in the Congo, *Terminalia superba* is cropped with cocoa and banana in experimental plots. In the Ivory Coast, oil palm is intercropped with coffee, cocoa and hevea (Tchoume, 1981). Coffee, maize and banana are intercropped with *Grevilla robusta* for timber in Tanzania. A 3-tiered "farm-forest" in Southern Senegal brings together Bora-

ssus (Palmyra), *Adansonia digitata* and *Acacia albida* with millet, groundnuts, and sorghum. The perennials, called "farm trees", are used for the supply of firewood, fodder and food when associated with pastures, and they are grown in stands for livestock to browse (Niang, 1980). In Sierra Leone, *Gmelina arborea*, *Tectona grandis* and *Cassia siama* are intercropped with cocoa, cola and coffee. (Koroma, 1983) and *Terminalia ivorensisis* and *I. superba* are undergrown with banana, coffee, cocoa and cola which in turn cover maize, cassava and sweet potatoes. In Uganda, mangoes, barkcloth (fig) trees and coffee are intercropped with bananas, yams, pumpkins, sugar cane, beans and tomatoes.

To gain some idea of the economic output, it is reported from Nigeria that 10,000 hectares of timber and field crops have been yielding US$ 5 million a year. Past results also indicate that *Sorghum vulgare*, *Eleusine coracana* (millet) and *Cajanus indicus* (*pigeon peas*) are not very suitable for agroforestry since they compete too well with the young trees for moisture.

There must be many more similar results which can be collected and applied to various sites. The excellent performance of *Acacia albida* in the Sahelian region has led to it being recommended as a model for agroforestry there. Even in infertile sandy soils it causes a doubling of the yield of crops grown under or near it (Nair,1983).

10.9.2. **Future Research**

The task ahead is big and complex. Because successful establishment of agroforestry systems is specific to ecological zone, soil type and cultural and economic preferences of rural peoples, there is need to design technologies specific to all these conditions and based on sound empirical data. For this purpose, African countries would need to promote indigenous research that will have continuity to permit possible future adaptations of the agroforestry systems that may become necessary.

But the first step would need an assessment exercise to determine community and other needs for land area, personnel, economic inputs, forests, products, (fuel wood, charcoal, pulp, gums, resins, etc.)

(a) *Biological and ecological research* .
Detailed studies have to be made of soils in relation to fertility, stability and support of the growth of multiple vegetation types and carrying capacity.
—of tree and shrub species for their yields of fuel, pulp, pharmaceutical products, etc.; their growth rates, provision of shade;
—of field crops compatible with specific perennials; their growth and yields under different tree covers;
—of the ecological requirements, pests, diseases of both annuals and perennials;
—basic biology of so-called exotic species of trees and field crops which could prove suitable for agroforestry plantations, e.g. *Acacia auriculiforms* and the winged bean, *Psophocarpus tetragonolobus*.

(b) *Socio-economic Research*
Studies are needed on the factors that determine preferences for specific tree-crop combinations; the management strategies that give optimum yields

and multiple harvest; the effect of agroforestry on rural employment, contributions to national production and revenue, long-term effects on rural development, standards of living, farm yields, environmental preservation, forest regrowth and regeneration; local initiative and collective autonomy. Economic effects of infrastructural development on rural development.

(c) Sociological Research

Studies are needed on social and cultural barriers to the integration of women into the rural economic structure; data collection on women's economic contribution to the rural economic and overall rural development, the social implications, and the short-and long-term consequences of agroforestry e.g. possible effects on social cohesion arising out of modified roles of women; out-migration, motivation towards accelerated community improvement.

These are samples of the kinds of research that would be needed to support the introduction and proper management of agroforestry systems if they are to produce maximum and lasting benefits to rural communities. Doubtless, there are many more aspects and topics of research which could emerge as the studies get under way.

10.9.3. Conclusion

One can only repeat the observation of the UN Conference on Desertification in 1977 which says that from an analysis of the causes and process of desertification it is clear that the spread of the desert cannot be halted by costly re-afforestation projects. "The only possible solution in the affected areas lies in the rehabilitation of the Sahelian pastoral economy with due regard for the forestry and agriculture aspects". This approach was to involve "a harmonious partnership between the traditional knowledge of the Sahelian pastoralists and the resources offered by modern technology".
The same applies to other areas of Sub-Saharan Africa.

10. SAMPLE UNITS:

UNIT ONE STUDY OF ECOSYSTEMS

(Ref. Source Book for Science Teachers, SEPA, 1979)

10.10.1. (a) **Introduction**

Consider a township with its surroundings, farming villages, people, animals (domestic, wild), and plants. Emphasise their interdependence for food, shelter and possibly, care. Animals and men depend on green plants for food; plants in turn depend on soil and air and sunlight that falls on the area. Any area with its own characteristic set of interdependent and interacting entities, some living others non-living, is called an *ecosystem.*

Think of other ecosystems; in each case, list the non-living and the living components. Also, list pairs of the components and indicate in what way one member depends upon the other, or how the two interact.
Two aspects which might easily show interdependence of the components of an ecosystem are food and shelter.

Direct observation may disclose these e.g. patient observations may show animals feeding on plants (cattle grazing, birds nesting on trees or feeding on nectar of flower) or on other animals (lizards feeding on small insects). All these examples are linked conceptually by the term ecosystem.

(b) **General Objectives**

Skills development is an activity-oriented process. The objectives of this study are to give the learner an opportunity to understand the meaning of the concept ecosystem by engaging in a series of activities that give him first hand experience of of the workings of an ecosystem. They are also to help him relate the concept of an ecosystem to the agroforestry systems that he will study and/or operate or establish.

(c) **Specific Objectives:**

(i) To provide the learner with a series of activities that reveal relationships between animals and plants in a specific ecosystem.

(ii) To provide the learner with preliminary learning activities that help him to identify natural ecosystem and their specific components.

(iii) To provide the learner with activities that help him to analyze some ecological relationships between animals, plants and the physical environment.

(d) **Activities:**

(A) *Preliminary activities:*

(i) Observation of small plot of open land. The observations are brought into focus by a series of questions such as:

—What animals come to feed on the green plants (list as birds, ants, bees, butterflies, goats, etc.)?

—How long or how much does each consume (of leaves, flowers, nectar, fruits etc.)?

—Do the consumers show preference for the parts of the plants, insects on the plants, etc.?

—Do you recollect having observed any seasonal variation in the abundance or

—quality of the food and/or in the abundance of the consumer(s)?

(ii) Observation of parts of ecosystem in-doors or in garden. Parts of ecosytems may be reproduced in a classroom or garden e.g.

—termite mound

—an aquarium with submerged green plants and small fish.

—Colonization of a freshly exposed substratum (bread, milk, bare patch of soil in the garden).

(iii) Extension to man

Food webs or lines indicating dependence should be followed as far as possible to man; e.g. grass in pasture depends on soil, sheep graze grass (as food); man feeds on sheep and uses its skin, dead sheep and man return to soil and nourish grass.

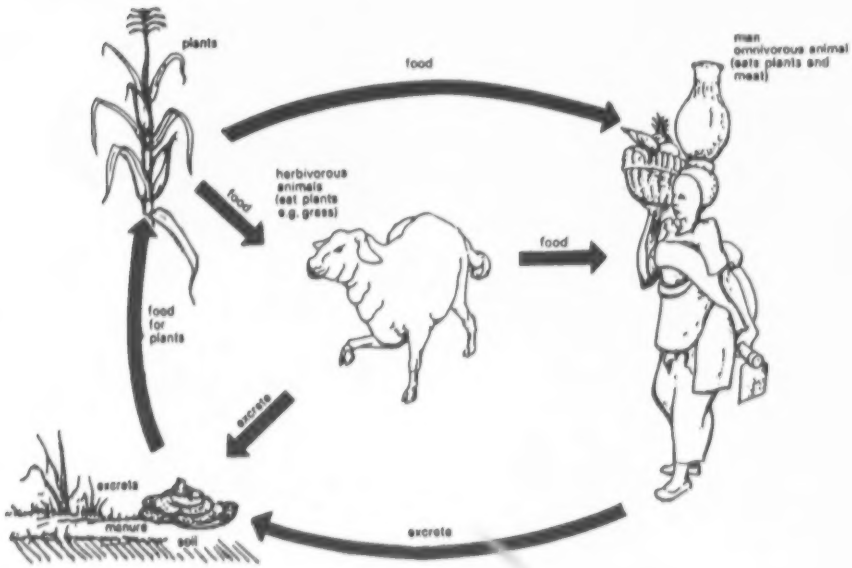

Fig. 36: *Nature's food web.*

Also the effects of man's activities on components of the ecoystem could be studied and, as far as possible, measured and evaluated, e.g. loss of vegetation leads to loss of soil through erosion: how much soil is lost this way over a green period through wind and rain? A simple experiment can be designed to measure this.

Illustrations of desert soils, sheet erosion on slopes, etc. can be made with slides. Other examples of human activities include dams, large artificial

ponds, factories that pour out effluents into the atmosphere, rivers, and streams; spent oil from car service stations, oil or tar on beaches. Large-scale deforestation (what happens to animals that live in those forests, e.g. large mammals, small game, birds, insects, reptiles, butterflies, etc.?)

Related Concepts in study of ecosystem: Environment, ecology, food chain, food web, primary produces, consumer, feedback action, cycling, recycling, fluctuation, pollution, ecological balance, conservation.

(i) *Detecting the presence of air:* The learner may fan himself and describe what he feels. Is there any difference in feeling when he fans faster or more vigorously?

(ii) Allow learner to try filling a tumbler with water by pushing the tumbler upside down straight into the water. What happens when the tumbler is filled while it is still under the water? (a bottle can be substituted for the tumbler).

(iii) Observation of what happens when small pieces of paper or leaves are thrown up (into the atmosphere). Let the learner compare these observations with those using a piece of stone.

(iv) Let the learner run with an open umbrella and later with the umbrella closed; and compare the two experiences.

Fig. 37: *Factories pollute the environment with their effluents.*

B. *Specific learning activities:*

1. *Activities with air*

In dealing with air as an ecosystem it is important to understand its reality. A start can be made by questioning e.g. How do we detect the presence of air? What is the evidence that air is real? (How can we see air?)[1]

Air can push things

(i) How can we use air to push objects. The learner may try this out by making a card-board model of a wind mill mounted on wood and observing how it works in gentle and in strong wind.

(ii) Let the learner try to make light objects move by blowing air into them.
(iii) Let the learner make paper propellers and discover how they are worked by the air.
(iv) Let the learner fly a paper kite and observe changes in the tension on the string. What happens when the string is increased in length?

The instructor can discuss possible application of some of the above observations to man's daily life. Related concepts: Volume, Pressure, Force, Density, Buoyancy, Air Current, Ventilation, Expansion, etc.

2. *Activities with water*

There are usually several pools along the course of various rivers and streams, especially during the dry season. These can constitute, when they are virtually cut off from the main flow, acquatic ecosystems which can be studied with profit.

Identifying the components of an aquatic (fresh water) ecosystem

(i) Learners are encouraged to list the various living and non-living components in the ecosystem e.g. fish, snails, submerged green plants, (mosses, grasses, etc.) rocks, dead tree branches, shells, algae, etc. and the water itself.
(ii) Learners are asked to construct a possible (or observed) food web in the ecosystem and show possible flow of energy within the system.

10.10.2. UNIT TWO: SETTING UP AGROFORESTRY SYSTEMS

(a) *Introduction:*

Agroforestry systems are common in the rural environment, but may not be identified as such by many people. For purposes of training, two approaches short-term and long-term are possible. The short-term approach allows the learners to realize the objective of taking part in the setting up and harvesting of a partially established system. The long-term approach permits the learners to set up an agroforestry system from scratch so that it may mature over a number of years.

(b) *Objectives:*

The primary objective is to give learners a first hand experience in establishing a viable agroforestry system so that they can later teach others to do so successfully. Specifically,

(i) Learners are provided with an opportunity to establish, within a forest plantation, an agroforestry system containing two levels of annuals in addition to the trees, so that they can be harvested at different times within a year.
(ii) Learners are given opportunity to establish an agroforestry system consisting of young trees, shrubs, and two or three different annual field crops, starting from a cleared plot of land.

(c) *Activities:*

(*i*) *Preliminary Activities*

(a) Learners are asked to explore suitable areas which contain tree plantations under which field crops can be grown. Questions to ask include:

Is much sunlight coming through the trees?
Are the trees spaced widely enough to accommodate other plants? Can you recall ever seeing other crops grown with such trees?

(b) By means of group discussion, learners are encouraged to select provisionally one or two areas for a year's project in agroforestry. Various areas are compared on the basis of canopy, shading, spacing and termite moulds in areas, etc.

(c) Learners are encouraged to negotiate with owners the possible use of the land for the agroforestry project. They learn how to justify the project in terms of its usefulness to society in general, to the community in particular, to agriculture, land management and use.

(*ii*) *Specific Learning Activities: Short-term*

(a) Test of soil for suitability for field crops. Studies may have to be carried out by a soil laboratory. Students/learners are encouraged to appreciate the importance of soil testing before planting. Learners may estimate organic matter in a sample of soil by burning a known weight until all incinerable matter has been burnt off (i.e.to constant weight).

(b) Learners begin to decide on possible field crops on the basis of the results of the solid test received from the soils laboratory. Discussion and reference to literature will aid the decision. A short list of possible crops is made.

(c) Soil Tests: Samples of the soil are taken from various parts of the land, labelled and sent off to be tested at a soil laboratory.

(d) Decision on possible tree-crops combinations: Learners begin to decide on possible field crops on the basis of the soil tests results. Possible compatible trees are also decided upon on the basis of agreed criteria.

(e) Preparation of land:
Learners help to prepare the land for cultivation. Plan of the layout is made to show whether the trees are to be arranged as a windbreak or for more widespread cultivation as fuel wood and fruit trees, etc. The land is finally prepared for planting.
Planting:

Learners are helped to plan dates and sequence of planting trees and field crops. The plants are put in according to the agreed schedule.

(f) Weeding and Mulching;
Later, young plants are weeded and mulched. Organic manure is added as necessary.

(g) The annuals are harvested at the end of the first growing season and the trees are allowed to grow, with some pruning if needed.

(h) The annuals are replanted to start another cycle.

(i) Species selection for cultivation:

Possible crops are now selected on the basis of shade tolerance, growing period, matching with tree species in the plot.

(j) Planting: Learners are helped to plan dates and sequence of planting the field crops. Soil is prepared and the crops are planted with suitable spacing and in the correct order.

(k) Later the young plants are watered if necessary. Also they are weeded; the trees are pruned if necessary and the plants are all mulched. Organic manure may be added as required.

(l) At the end of the growing period the crops are harvested in turn. The trees also are harvested (of fruits and fronds).

Possible combinations for this short-term system:

A plantation of oil palm which are already mature or about to mature within the year. These form the trees of the third level. Under this level are possible cassava or black-eyed beans which form the second level of plants.

Groundnuts then may form the cover crop as the first level of plants. Alternatively, *Pueraria* may be planted as a cover crop for sheep and goats to graze.

(iii) *Specific Learning Activities: Long-Term*

Choice of Land:

A survey and inspection of available land gives the learners an opportunity to evaluate agricultural land for agroforestry. Criteria for suitability are established and discussed. Note is taken of the fact that usually only marginal lands are given over to agroforestry.

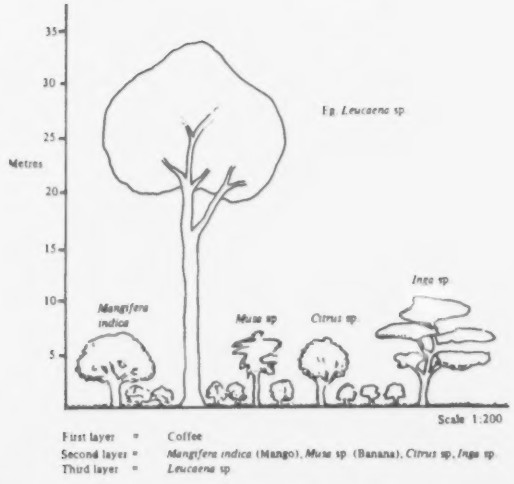

Fig. 38: *Agroforestry system – coffee/shade tree combination.*

(iv) *Possible tree-crop combinations:*

For this long-term system, the first layer could consist of coffee. Cover crop such as *Pueraria* or *Calapogonium* could be sown underneath the coffee trees for sheep and goats to browse. Second layer could consist of shade trees like mango, or citrus (oranges, lemons, tangerines). Third layer could consist of a periphey of coconut trees, bread fruit, or jack fruit or even plum trees including a fast growing tree like *Leucaeña* sp. (see fig. 1)

Curriculum Content: Agroforestry

(1) *Basic Science*
- (i) Elementary biology and ecology
- (ii) Soil and land types and carrying capacity
- (iii) Concepts of ecosystem
- (iv) Forest ecology
- (v) Elementary forest management
- (vi) Economic plants and animals
- (vii) Elementary farm management
  - (a) Estimation of profit and loss
  - (b) Storage marketing and distribution
- (viii) Food production in relation to population
- (ix) Nutrition.

(2) *Fundamentals of Rural Development*
Concept of rural development.

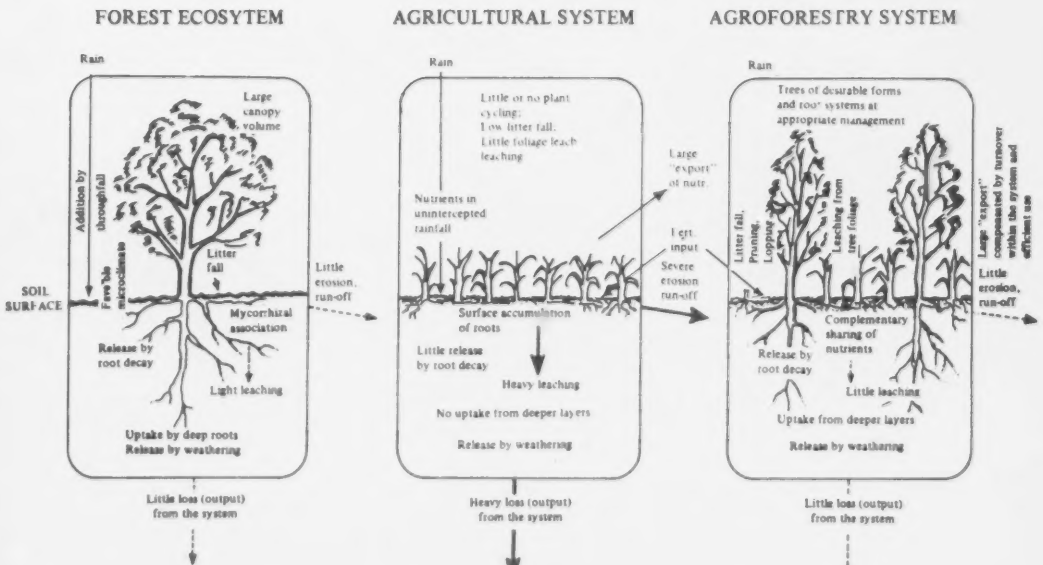

Fig. 39: *Schematic presentation of nutrient relations and advantages of agroforestry systems in comparison with forestry and agricultural systems.*

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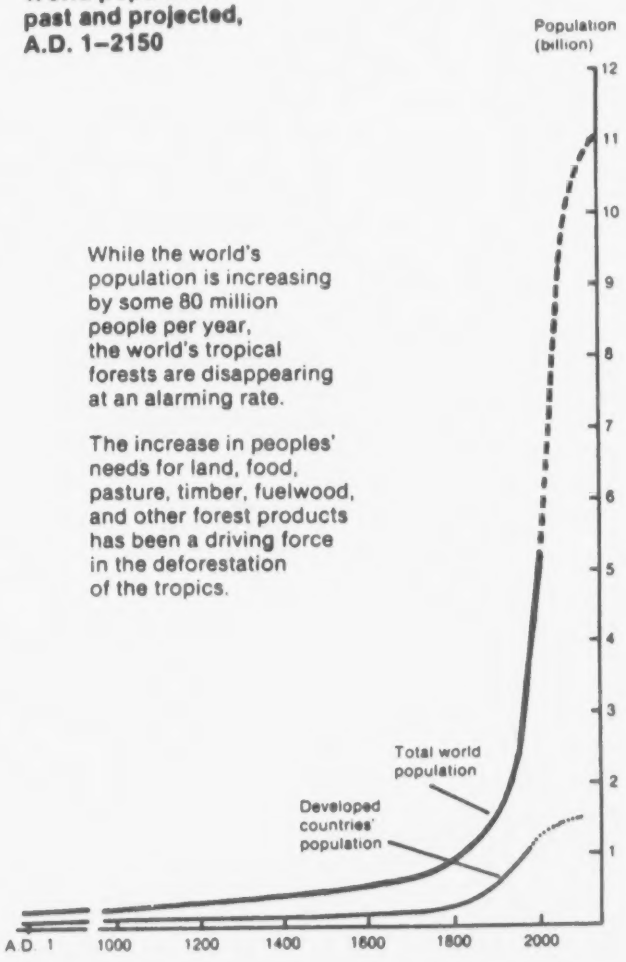
11.

THEME III

POPULATION, ENVIRONMENT AND DEVELOPMENT

World population past and projected, A.D. 1–2150



Source: *World Development Report*, 1984, World Bank.

Fig. 40: *World population – past and projected A D 2150.*

11.1. INTRODUCTION

Humankind is an integral part of the environment. People's actions and beliefs affect the environment, and the environment in turn influences their actions and beliefs. Humankind's actions and beliefs and the influence of the environment determine human numbers. Human numbers are usually referred to as population. The science of population is called demography. The characteristics of these human numbers in terms of size, space, employment, composition, and rates of growth as determined by deaths and migrations have important consequences for the environment, and hence on development of society.

11.2. STATEMENT OF PROBLEMS AND ISSUES

Population has significant implications for the environment. Some of the population aspects that have important consequences for the environment include *fertility* and family size, *morbidity* and *mortality*, *rural* and *urban distribution* of the population, *employment structure*, *age and sex structure* and *the rate of growth of population*. We shall have occasion to explain the meaning of the concepts contained in the above *Italicised* words and phrases.

Factors within the environment in turn affect population aspects by determining the degree or level at which they operate. For example, outlined beliefs affect fertility and family size while the state of environmental health also affects mortality levels.

11.3 BRIEF EXPLANATION OF SOME DEMOGRAPHIC TERMS

Before going into more details with this theme, it would do us a lot of good if we explained some of the demographic terms which we are likely to meet in the course of the theme, some of which have already been mentioned above.

11.3.1. Age and Sex Composition

Age and sex are the most basic characteristics of a population. Every population has a different age and sex composition—the number of proportion of males and females in each age group—and this structure can have considerable impact on its demographic and socio-economic behaviour.

11.3.2. Sex Ratio

The sex ratio is the ratio of males to females in a given population, usually expressed as the number of males for every 100 females, e.g.

$$\frac{\text{Number of males}}{\text{Number of females}} \times 100$$

11.3.3. Age-Dependency Ratio

The age-dependency ratio is the ratio of persons in the "dependent" ages (under 15 and over 65 years,) to those in the "economically productive" ages (15-64 years) in a population, e.g.

$$\frac{\text{Population under 15 + population 65 and over}}{\text{Population age 15-64}} \times 100$$

11.3.4. Fertility

Fertility refers to the reproduction performance of males, females, or couples in a population. The production of live births in a population is related to the number of marriages, the age at marriage (or cohabitation)

the availability and use of contraception and abortion, economic development, the educational and occupational status of women, and the age-sex structure.

11.3.5. **Birth Rate**

The Birth Rate (also called crude birth rate) indicates the number of live births per 1000 population in a given year e.g.

$$\frac{\text{Number of births}}{\text{Total population}} \times 1000$$

11.3.6 **Mortality**

Mortality refers to deaths as a component of population change. Eventually death occurs to every population member, but the rate at which it occurs depends on many factors, such as age, sex, race, occupation, and social class—and its occurrence can reveal much about population's standard of living and care.

11.3.7. **Death Rate**

The death rate (also called crude death rate) is the number of death per 1000 population in a given year,

$$\frac{\text{Number of death}}{\text{Total population}} \times 1000$$

11.3.8. **Infant Mortality Rate**

The infant mortality rate is the number of deaths to infants under one year of age per 1000 live births in a given year, e.g.

$$\frac{\text{Number of deaths to infants under age 1}}{\text{Total lives births}} \times 1000$$

11.3.9. **Life Expectancy**

Life expectancy is an estimate of the average number of additional years a person can expect to live based on the age-specific deaths rates for a given year.

11.3.10. **Marriage Rate**

The marriage rate (also called crude marriage rate) is the number of marriages per 1000 population in a given year. This rate is calculated using the number of marriages—not the number of people getting married, and includes both first and re-marriages.

11.3.11. **Divorce Rate**

The divorce rate (or crude divorce rate) indicates the number of divorce per 1000 population in a given year. This rate is calculated using the number of divorces—not the number of people being divorced.

11.3.12. **Migration**

Migration is the movement of population; more exactly, the movement of people across a specified boundary for the purpose of residing. Along with fertility and mortality, migration is a component of population change. The terms immigration and emigration are used to refer to movement between countries (international migration). The parallel terms in-migration and out-migration are used for internal movement between different areas within a country (internal migration).

11.3.13. **Immigration Rate**
The immigration rate is the number of immigrants arriving at a destination per 1000 population at that destination in a given year.

11.3.14. **Emigration Rate**
The emigration rate is the number of emigrants departing an area of origin per 1000 population at that area of origin in a given year.

11.3.15. **Net Immigration**
The net effect of immigration and emigration on an area's population can be expressed as increase or decrease.

11.3.16. **Facts and Figures Zimbabwe 1982**
Crude Birth Rate—49 per 1000
Crude Death Rate—between 15 and 16 per 1000
Rate of Natural Increase—about 3.1 % per annum.
Infant Mortality Rate—between 90 and 100 per 1000
Sex ratio—no figures available
Proportion of Population under 15—50 %
No figures are available for the marriage and divorce rates.

11.4. AIMS AND OBJECTIVES

11.4.1. **General Objectives.**

4.1.1. To create awareness of the critical relationship between population, resources and environment for the purpose of development.

4.1.2. To enable adult learners to understand how their actions and beliefs contribute to certain population situations which pose problems for the environment.

4.1.3. To make adult learners appreciate and be conscious of the fact that changes in their actions and beliefs would also result in changes in the population situation, and these in turn would affect their actions and beliefs.

4.1.4. To effect change in the actions and beliefs of adult learners so that population problem is alleviated and their quality of live improved.

11.4.2. **Specific Objectives**

4.2.1. To maintain balance between population, resources and environment to achieve sufficiency in the following: food, health education, housing, and employment for all, and equitable distribution of land.

4.2.2. To educate, motivate and provide information about planned parenthood, e.g. child-spacing and family life.

11.4.3. **Strategies for Teaching These Objectives**
The main consideration here is that population issues should not be presented in isolation from other moral, cultural, religious and socio-economic issues, but should be infused and integrated into the broad topical areas that are already of interest to adult learners. Population issues, and those other issues relating to the number of children parents

ought to have, are extremely sensitive. They arouse hot debate and hot passions to such a level that only those programmes in which the parents have willingly agreed to participate and contribute their own ideas and wisdom stand any chance of succeeding. The rest are likely to fail. The second point to bear in mind is the sensitivity of the whole issue of family planning/child-spacing which appears to encroach upon an individual's private sex life. As such it is likely to arouse passionate objection.

The third point to consider is the linkage of population studies to real concrete issues of socio-economic nature.

Considering the above, the adult educator must exercise the greatest care and caution in respect of people's cultural and religious practices, emphasizing their strong points and underplaying their weaknesses with the aim of eliminating the latter. It is bound to be a painful and slow process, and the adult educator should be prepared for this.

11.5. METHODOLOGIES TO BE USED AND ACTIVITIES TO BE UNDERTAKEN

For adult learners to take population issues seriously, the adult educator must combine discussion with relevant data taken from the areas familiar to the students. Let the learners discuss such issues as:

- The number of children the average couple have in the community.
- What are the advantages of having many children?
  What are the advantages of having children? If you are rich? If you are poor?
- What are the advantages and disadvantages of having no children?
- What is the meaning of family planning?
- What are the traditional methods of family planning? Their advantages? Their disadvantages?
- What are the attitudes of most of the people in the community towards family planning? Why?
- Do women have different attitudes towards family planning for men? Why?
- What is the government's attitude towards family planning? Why?
- What are the women's and men's doubts and fears about different methods of family planning? Why?
- In what ways do family planning programmes meet peoples needs? In what ways do they abuse people? What have you yourself experienced?
- Should parents be rewarded or given incentives for planning their families? Why or why not? How does the reward system affect people's attitudes about family planning? About the government? About themselves?
- In many countries illegal abortion is a common form of 'family planning'. Why? What are the results?
- Is it better to abort or to bring an unwanted child into the world?
- Is family planning important? For whom and in what ways?

The above are a few of the issues which can be brought up for discussion and debate. The way the discussions are held should vary from one area to another, depending on customs and beliefs of the people. In some areas it might be possible to have men and women together in adult classes, while in others, especially traditional muslim areas, it might be difficult to bring the two sexes together to discuss such controversial and delicate issues.

In addition to holding class discussions on points raised above, other techniques may be employed. These would include the following:

- Case study method/incident process
- Demonstrations
- Field trips
- Role playing
- Symposiums/panels/forums.
- Simulation/games

Instructional aids required should include:

- Displays and exhibits
- Films, filmstrips, flannelgraphs, flip charts, etc.
- Handouts.

11.6. OUTLINE OF CONTENT TOPICS

11.6.1. **Historical growth of world population, beginning with one's country:**
This first topic should set the stage for the discussion of population and environmental problems. Important concepts to be considered include *births, deaths, natural increase, life expectancy.*

- Trace the growth of world population from Neolithic (very early) times, through the present, and project to the year 2000. Begin this topic with growth of population in the students' country. Use block graphs to illustrate the concept of population increase.
- Show components that have contributed to this growth, namely, births and deaths operating together as natural increase.
- Discuss problems that have affected the level at which each of the components have operated throughout history, e.g. development of agriculture, growth of settlements, industrial revolution, improvements in personal hygiene and public health, medical science and technology, and the role of contraception.
- Adult learners should also appreciate the contribution of their respective countries, and Third World countries and their communities to global population growth.
- Finally, discuss the consequences of world population growth on the environment.

11.6.2. **Population size, distribution and density**

Important concepts include *population pressure, high density, low density, overcrowding, urban and rural.*

- Discuss population size of the country or community for the past fifty years (depending on availability of demographic data.)
- Discuss distribution of population within the country (administrative areas, rural/urban).
- Factors which influence distribution of population, e.g. physical, social, economical, historical, soil fertility, etc.
- Rates of urbanisation and problems of urbanisation, overcrowding, shanty towns (slums), reduction in per capita of food production, etc
- Consequences of population distribution and size for planning.

11.6.3. **Population structure**

Important concepts include: *Age group, youthfulness, ageing, age pyramid, dependency ratio, dependency burden, age ratio, sex ratio.*
Discuss the following:

- Age and sex structure of the population
- Determinants of age and sex structure (births, deaths, migrations).
- Types of age structure (youthful, ageing); sex ratio (e.g. excess of one sex over the other and its consequences).
- Consequences of types of age/sex structure for the community. Dependency ratio and dependency burden. (e.g. about 50% of the population in Africa is under 15 years. What are the consequences of such age structure distribution for the community/country?)

11.6.4. **Population Composition**

Even though there is a long list of components for this section, the important components for adult learners are: *education, employment and marital status.*

Discuss

- Structure of employment, levels of employment; women's labour force participation, the family as a labour unit and the effects of family size.
- Marital status (single, widowed, married, divorced, separated. with children but never married)
- Age at marriage and its effects on family size.
- Need to postpone marriage to a later age in order to reduce period of exposure to child bearing (in the absence of effective contraception.)

11.6.5. **Population Change**

The concepts include: *fertility, mortality* and *migration.*

Discuss the following:

- The three components of population change: fertility, mortality and migration.
- Fertility is affected by age at marriage, the proportion of children born over those who die, contraception, mother educational status, social/econonomic status, etc.
- Mortality is high, e.g. in West Africa sub-region and is concentrated in infancy and early childhood.
- Maternal mortality
- Show how mortality is affected by educational status, types of employment, socio-economic status.
- Migration, especially rural-urban migration, and its effects for both urban and rural areas.
- Characteristics of migrants, reasons for moving and consequences of migration for both rural and urban communities.

11.6.6. **Consequences of population change**

The concepts include the following: *pollution* of land, water and air, *economic productivity*.

Discuss the following:

- Rapid population growth, doubling time and differing rates of population growth.
- The consequences of rapid population growth for the environment e.g.
  - —food production, distribution and consumption
  - health
  - —economic productivity
  - —pollution of land, water and air
  - —deforestation and desertification due to pressure on land
  - —employment
  - —housing conditions in urban communities.

11.6.7. **Population data**

- Discuss the importance of population data for community planning—for schools, health, roads, water, etc.
- Show how individual action contributes to the availability of reliable population data for community, e.g. prompt reporting of births, deaths, migrations, etc.
- Emphasise the need for the registration of births and deaths, and co-operation with data collection agencies such as Central Statistics Office.

11.7. FACTS AND FIGURES RELATED TO THE THEME

Historical Growth or World Population Estimates of world population size

DATE	*TOTAL*
8000 B.C. (Neolithic)	5 million
1100 B.C. (Iron age)	10 "
1650 A.D.	500 "
1750 A.D.	791 "
1850 A.D.	1262 "
1950 A.D.	2515 "
1980 A.D.	4432 "
2000 A.D.	7000 "

Annual rate of world population growth is 1.7 per cent per annum in the 1980's. This means that 75 million individuals are added annually to the world's population. Three fourths of the worlds' population is in developing countries where the average annual rate of growth is 2.1 per cent per annum. Africa has the highest annual rate of growth in the period 1975—1980, namely 2.9 per cent per annum. *Demographic transition* explains how birth and death rates declined over time in the currently developed countries. This decline on average take at least a hundred years. In the case of the developing countries birth rates are still very high but death rates have declined considerably resulting in very rapid rates of population growth.

POPULATION SIZE, DISTRIBUTION AND DENSITY

Table 1

Population size by major area (Millions)

	1960	*1970*	*1975*	*1980*	*1990*	*2000*
Africa	275	355	407	470	635	853
East	77	100	115	134	183	250
Middle	35	42	47	53	70	91
North	65	83	94	109	144	186
South	20	25	29	33	44	58
West	79	104	121	141	195	267

Source: UN. Year book

West Africa densities outside the arid regions are closer to those found in most of the world.

Table 2

In 1967 densities were as follows:

Country	*Population (thousands)*	*Density (per sq. km.)*
Mauritania	1100	1.1.
Senegal	3670	18.7
Gambia	343	31.2
Mali	4697	3.8
Upper Volta	5054	18.4
Niger	3546	2.8
Guinea (Bissau)	528	14.7
Sierra Leone	2439	33.9
Guinea	3702	15.0
Liberia	1110	10.0
Ivory Coast	4010	12.5
Ghana	8139	34.1
Togo	1724	30.8
Dahomey	2505	22.2
Nigeria	61,450	66.5
TOTAL	104,017	16.09

Source: U.N. Year book —1968

URBAN POPULATION SIZE (MILLIONS)

Table 3

Rate of urbanisation is another important aspect of urbanisation

	1970	1980	*1990*	*2000*
Africa	81	135	224	350
East	11	22	41	71
Middle	10	18	30	44
North	30	48	75	108
South	11	15	22	31
West	18	32	56	95

Table 4

Urban average annual rate of growth

	1970-1975	*1975-1980*	*1980-1985*	*1985-2000*
Africa	5.1	5.2	5.8	4.6
East	7.0	7.0.	6.8.	5.7.
Middle	5.7.	5.5.	5.2	4.2
North	4.5	4.7	4.5	3.9
South	3.1	3.5	3.7	3.5
West	5.6	5.7	5.7	5.4

Table 5

Proportion on population in urban areas

	1970	*1980*	*1990*	*2000*
Africa	22.8	28.8	35.5	42.2
East	10.6	16.1	27.8	29.4
Middle	25.1	34.5	43.8	51.5
North	36.9	44.2	51.9	59.0
South	43.8	46.5	51.4	57.7
West	17.4	22.5	28.9	36.2

Table 6.

Population structure (Age and sex)

structure of population by broad age groups Less developed nations 1950-2000 (Percentage distribution)			
	0-14	*15-64*	*65+*
1950	38.2	57.3	4.4
1960	41.1	54.9	4.1
1970	41.8	54.3	3.8
1980	39.1	56.9	4.0
1990	35.5	60.2	4.4
2000	33.2	61.9	4.9

Table 7.

Percentage age/sex distribution of Sierra Leone's Population—1974

AGE GROUP	*MALES*	*FEMALES*
0-4	15.97	16.26
5-9	15.45	15.14
10-14	9.96	8.50
15-19	8.10	9.36
20-24	6.84	8.10
25-29	7.98	9.07
30-34	6.40	7.13
35-39	6.08	6.05
40-44	4.85	4.57
45-49	4.33	3.62
50-54	3.48	2.93
55-59	2.38	1.88
60-64	2.57	2.30
65+	5.61	5.09
TOTAL	100.0	100.0

Table 8

Population distribution by Administrative Regions Sierra Leone 1974

Region	*Population*	*Density (Per Sq. km)*
Sierra Leone	2,735,159	38
Southern Province	596,758	30
Bo District	217,711	42
Bonthe District	87,561	25
Moyamba District	188,745	27
Pujehun District	102,741	25
Eastern Province	775,931	50
Kailahun District	180,365	47
Keneme District	266,636	44
Kono District	328,930	58
Northern Province	1,046,158	29
Bombali District	233,626	29
Kambia District	155,341	50
Koinadugu District	158,626	13
Port Loko District	292,244	51
Tonkolili District	206,321	29
Western Area	316,312	568
Freetown	276,247	4000

Also produce a Map of Sierra Leone showing the above distribution. Obtain similar figures for your country.

Table 9

Distribution of Localities Size Sierra Leone 1974

Locality size	*Number Of Locality*	*Total Population*	*Of Total Population*
All localities	17,440	2,735,159	100.0
100, 000 or more	1	276,247	10.0
50,000—99,999	1	75,846	2.8
20,000—49,999	3	97,610	3.6
10,000—19,999	4	52,363	1.9
5,000—9,999	11	69,999	2.6
2,000—4,999	55	180,061	6.6
1,000—1,999	138	189,794	6.9
500—999	423	282,172	10.3
200—499	1,930	575,087	17.0
100—199	3,311	465,120	17.0
Less than 100	11,563	470,860	17.2

EXERCISE 1

Draw age/sex Pyramids for less developed regions and Sierra Leone

Sex ratios by administrative regions Sierra Leone 1974

Region	*Sex ratio (Number of Males per Female)*
Sierra Leone	98.8
Southern Province	93.8.
Bo	94.8
Bonthe	95.6
Moyamba	93.6
Pujehun	91.0
Sherbro urban	95.9
Eastern Province	109.7
Kailahun	92.0
Kenema	104.5
Kono	125.8
Northern Province	90.9
Bombali	87.7
Kambia	90.7
Koinadugu	92.0
Port Loko	93.2
Tonkolili	90.5
Western Area	111.9
Freetown	112.0
Western rural area	105.3

Age Dependency Ratios for Developed regions

1950—2000

Year	*Total (A)*	*Childhood (B)*	*Old Age (C)*
1950	74	67	8
1960	82	75	7
1970	84	77	7
1980	76	69	7
1990	66	59	7
2000	62	54	8

(A) Total age dependency ratio is the sum of the childhood dependency ratio and the old age dependency ratio.

(B) Childhood dependency ratio is the ratio of the population age 0-14 to those aged 15-64 multiplied by 100.

(C) Old age dependency ratio is the ratio of the population aged 65 and over to those aged 15-64 multiplied by 100.

Table 10

Growth in urban centres of size class 10,000 or more inhabitants

Sierra Leone—1974	*Population*			
Area	*Actual 1963*	*Expected 1974 (based on natural increase rate of 2·1%)*	*Actual 1974*	*Gain From Migration*
Greater Freetown	161,258	205,604	316,312	110,708
Koidu/New Sembuhun	14,309	18,244	75,846	57,602
Bo Town	26,613	33,932	39,371	5,439
Kenema	13,246	16,887	31,458	14,571
Makeni	12,304	15,688	26,781	11,093
Lunsai	12,132	15,468	16,723	1,255
Yengema	7,313	9,324	14,793	5,469
Port Loko	5,809	7,406	10,500	3,094
Magburaka	6,371	8,123	10,347	2,224
TOTAL	259,355	330,136	542,131	211,455

EXERCISE 2

POPULATION COMPOSITION (Education, Employment, Martial Status)

Include a table showing Distribution of the Population by age, Sex and level of completed schooling for your country.

Age group	*Level of completed Schooling*			
	Never	*Primary*	*Secondary*	*Higher*
		Males	*Females*	

Table 11

Fertility Estimates of fertility for West Africa

Country	*Period*	*Birth Rate (Per 1000 Population)*
Benin	1970—75	49.9
Gambia	1970—75	43.3
Ghana	1970—75	48·8
Guinea	1970—75	46.6
Guinea Bissau	1970—75	40.1
Ivory Coast	1970—75	48.7
Liberia	1971	49.8
Mali	1970—72	50.1
Mauritania	1970—75	44.8
Niger	1970—75	52.2
Nigeria	"	49.3
Senegal	"	47.6
Sierra Leone	"	44.7
Togo	"	50.6
Upper Volta	"	48.5

Source: U.N. Year book — 1977.

EXERCISE 3

Include another table showing enrolment ratios for the school age (3—24) population (for your country)

Age group	*Total*	*Never been to School*	*currently in School*		
		left School		*Males*	*Females*

Table 12

Fertility levels for Administrative Regions,

Region	*Sierra Leone—1974 Crude Birth Rate Per 1000 Population*	*Total Fertility Rate Per Woman*
Sierra Leone	48.7	6.01
Southern Province	45.7	6.230
Bo	45.0	6.044
Bonthe	44.3	5.946
Moyamba	40.5	5.712
Pujehun	49.2	6.554
Sherbro Urban	37.7	5.521
Eastern Province	49.3	6.443
Kailahun	46.8	6.446
Kenema	49.7	6.423
Kono	50.1	6.427
Northern Province	51.9	6.696
Bombali	54.0	7.203
Kambai	51.0	6.672
Koinadugu	51.0	6.243
Port Loko	49.1	6.469
Tonkolili	55.0	7.577
Western Area	42.0	5.948
Greater Freetown	42.5	5.261
Western Rural Area	40.6	6.228

Include table on mean number of children ever born by age of women and level of completed Schooling, Sierra Leone-1974 age group level of Schooling

EXERCISE 4

Include a Table showing distribution of the population by age, sex and marital status (for your country)

Age group, never married, marital status, currently married, widowed, divorced, separated, males, females 10—14 65+ 10—14 65+

EXERCISE 5

Include a table showing distribution of the employed population by sector:
Primary
Secondary
Tertiary

Percentage of the employed Labour Force in Agriculture by sex district—Sierra Leone 1974

District	**Percentage (Urban in 1974)*	*Males*	*Females*
Bo	23.3	76.3	90.0
Bonthe	4.8	87.5	74.0
Moyamba	10.4	83.8	81.1
Pujehun	4.8	84.1	92.0
Sherbro Urban	92.0	21.9	17.0
Kailahun	18.4	83.3	94.7
Kenema	24.3	72.8	88.2
Kono	45.0	82.7	71.0
Bombali	13.5	84.4	87.0
Kambia	15.5	88.5	91.2
Koinadugu	10.7	87.8	93.4
Port Loko	13.3	83.0	79.3
Tonkolili	9.8	87.8	86.5
Freetown	100.0	5.2	3.9
Western Rural	37.0	61.4	38.4
Sierra Leone	27.5	70.8	78.4

*Settlements with 2000. — inhabitants.

Table 13

MORTALITY

Estimates on Sub-regional Mortality Indices (1976)

Sub-region	*Crude death Rate*	*Infant mortality rate*	*Expectation of life at birth*
Africa	19	147	46
East	20	146	45
Central	20	164	42
North	14	128	52
Southern	16	119	52
Western	22	158	42

Source: Population Reference Bureau—1978
World population data sheet:

Table 14

Regional Levels of Mortality Sierra Leone-1974

Region	*Male q(2)*	*Mortality eo*	*Female q(2)*	*Mortality eo*	*Crude DEATH RATE*
Sierra Leone	.3020	33.0	.2680	35.90	38.04
Bo	.3290	31.32	.2920	29.69	29.69
Bonthe	.3110	34.20	.2750	36.92	28.36
Moyamba	.3290	31.33	.2910	35.86	29.96
Pujehun	.3830	28.56	.3400	34.89	32.80
Sherbo Urban	.2700	38.32	.2380	40.50	23.66
Kailahun	.3070	33.94	.2730	37.64	29.79
Kenema	.3350	31.20	.2970	34.33	29.74
Kono	.2860	34.60	.2540	35.75	24.00
Bombali	.2950	31.76	.2600	34.15	31.21
Kambia	.2920	32.61	.2580	36.32	29.24
Koinadugu	.2980	31.58	.2630	32.57	29.87
Port Loko	.2860	32.85	.2530	35.29	29.34
Tonkolili	.3290	31.12	.2910	34.13	30.67
Western Rural Area	.2620	36.47	.2320	41.05	24.55
Freetown	.2080	41.36	.1830	43.75	18.44

q(2) Population of children who die before the age of 2 years out of 1000 born within the same year.

eo Expectation of life at birth.

EXERCISE 7

Include Table Showing the Probability of Dying Before Age 2 Years of Children by Rural/Urban Location of Mothers (Sierra Leone 1974)

Age Group	*Rural*	*Urban*	*Total*
	q(2)	*q(2)*	*q(2)*
15—19			
20—24			
25—29			
30—34			
35—39			
40—44			
45—49			
All			

EXERCISE 8

Include Table Showing the Probability of Dying Before Age 2 Years of Children by the Mother's Level of Completed Schooling (Sierra Leone 1974)

Age Group	LEVEL OF COMPLETED			
	None	*Primary*	*Secondary*	*Higher*
15—19				
20—24				
25—29				
30—34				
35—39				
40—44				
45—49				
All				

Table 15

Migration

Inter District Migration Rates for Sierra Leone 1974

District	*In-migration rate (%)*	*Out-migration rate (%)*	*Net-migration rate (%)*
Bo	24.1	20.8	4.3
Bonthe	16.2	21.7	−6.6
Moyamba	20.1	21.8	−2.1
Pujehun	14.1	19.7	−6.5
Kailahun	10.0	14.3	−4.8
Kenema	30.0	12.5	25.0
Kono	45.8	4.8	75.6
Bombali	8.3	30.5	24.2
Kambia	8.6	20.4	13.0
Koinadugu	5.8	26.1	21.5
Port Loko	10.8	21.5	12.0
Tonkolili	7.9	23.4	16.8
Western Area	45.0	12.3	59.3

Table 16.

Consequences on Population Change

Average Annual Period Growth Rates for Sierra Leone

Period	*Rate (%)*
1960—1965	1.8
1965—1970	1.8
1970—1975	2.0
1975—1980	2.1
1980—1985	2.2
1985—1990	2.3
1990—1995	2.4
1995—2000	2.5

Table 17.

Doubling Time for Human Population

Rate of growth (%)	*Number of years for population to double*
1.0	70
2.0	35
4.0	17

11.8. POPULATION ISSUES AND CASE STUDIES

11.8.1 Case Studies

Population issues are better understood if seen in their historical perspective and in context of a particular family. The world over, agriculture is the mainstay of any economy. In pre-industrial times, agriculture in Europe and America was labour-intensive which provided for the use of manual labour for all agricultural activities. This is still the case in Africa where machinery has still not been fully utilised to replace human labour. Consequently, rural farmers still depend on manual labour using simple tools in traditional methods of farming to produce food mainly for local consumption.

Children in this regard are seen as assets to produce and to reproduce. The larger the family size the more the household is guaranteed of more labour for work on the farm. This trend in population growth has threatened the living conditions of people in Africa today. The following are some positive reasons for population control in Africa assuming that all population behaviour has determinants or causes, produces certain effects or consequences, and can be modified or altered by the appropriate actions of well-informed individuals or community as a whole.

CASE STUDIES (Rural Sierra Leone)

1. The Turay family in Makomp village consist of five boys, four girls, the father and his two nephews and the mother with her three nieces. The total number of members of the Turay family is thirteen, the nieces and nephews are accepted members of the family due to the traditional extended family relations practised.

   The head of the household Pa Turay, is a farmer earning his living on farming on five acres of upland farm and four acres swamp land. The entire family of thirteen depend on the income of Pa Turay, the head of the family.

The active labour force in the family comprises three people who include the father Pa Amadu Turay, old and not very healthy but has to take part in all the farming activities, one nephew aged twenty-one was seen as the second bread winner of the family and the third son of Pa Amadu Turay aged eighteen as the third bread winner. These three gentlemen are the direct producers of the thirteen members of the Turay family.

The six children are all within the age groups of one to ten while the two nieces, one nephew and two elder sisters live as dependants and only support the family at work minimally.

There are problems relating to the size of arable land for cultivation, the number of people to work on it, using simple tools and tedious traditional methods of farming, and none of them is literate to acquire a lucrative job because the cost of education is too high, above the income of the family. In times of plenty, i.e. harvest time, food is wasted. So much food is cooked that cannot be eaten by the entire members of the family. Consequently, during the rains, when food is scarce, very little is provided for the family. For both seasons, the quality of food necessary for a healthy living is never guaranteed although there are plenty of other nutritious foods, which if well prepared, could provide quality food for the family throughout the year.
There is hardship within the household of Pa Amadu Turay.

2. Pa Alieu Bangura's family consists of two boys and one daughter ages ranging from five to fifteen.
Pa. Bangura has only one wife and the eldest of the three children is a boy who has equal responsibility of providing of the family. Each year, Pa Alieu and his son Abu cultivate twenty acres of land. They grow mainly rice as the staple food and produce, each year, enough to feed the family throughout the year, sell some of it for other needs and keep enough seeds for the subsequent farming season. Besides the cultivation of rice, other foods like cassava, groundnuts, potatoes, pepper, and many other vegetables are grown mainly by the mother and her two daughters as their primary occupation, backyard gardening. Each year both harvests are put together and divided into the following:
(1) Seeds for the next season.
(2) Food to feed the family for the whole year.
(3) Food for the market to earn money to buy clothing, maintain the home, pay fees for the children etc.

The family of Pa Alieu Bangura of Makomp is healthy and happy throughout the the year.

QUESTIONS

(1) What are the main characteristic features of both families?
(2) Why can't Pa Amadu be in a position to provide good and enough food for his family?
(3) Why is there happiness in Pa Alieu's family?
(4) Discuss the possible social problems, not mentioned in the text that bring hardship in Pa Amadu's family?
(5) What are your suggestions if you are asked to counsel both families?

Ref: Illustrations on pages 92, 95 and 96 of the *P.E.A. Population Education modules.*

11.8.2 CASE STUDY ON POPULATION AT KROOBAY

(*One of the slums in Freetown, Sierra Leone*)

1. **Population situation:** The place is inhabited by both new and old migrants mostly from the rural areas. Some have lived there from time inmemorial. They are of various tribal groups—Foulahs, Limbas, Lokos and Themnes—the Themnes forming the largest group.

   Their dwellings are ramshackle buildings of rusty corrugated iron sheets forming both the walls and the roofs. They are over-crowded. A family of six or more lives in one small room. Their houses are surrounded by dirty, smelly, fly-infested gutters and ponds. Their case is that of complete neglect by the Health Authorities.

2. **Causes of this situation:** Most of them have been born there and have not found fortunes large enough that will enable them to leave the area and go to more attractive parts of the city where they can enjoy a better life.
   Being not far away from the centre of the city, the products of their small industries will find market.

   The fact that the area is Government-owned has also contributed to the present situation. One could go and acquire a small area and build a dwelling without being asked to pay. This has led to the lack of space to breathe. Nobody cares about the health situation of the areas. The fear, also, that the Government might enforce the law that requires them to leave the area has probably made them not build permanent dwellings.

3. **Its present and future consequences:** The present consequences of the situation are that:
   (a) The people's standard of health is very low.
   (b) They seem to live miserable lives as most of the modern amenities are lacking.
   (c) There is overcrowding. Since space is finite there will probably be no house planning project that will be of any benefit.

4. **Corrective actions which may be taken:** Before any corrective measures could be planned and effected it is necessary that the people should have a desire for a change. Somebody from within should initiate the change. But is there such a person?

   One can suggest literacy programmes and crash programmes of health to clear up the gutters and ponds and teach them the benefit of cleanliness. At the same time one would doubt the success of such programmes unless the people have been directly and intimately involved in these changes.

   Unless Government is interested in doing something, an ordinary voluntary organisation would find it difficult to improve the living standards of those people.

   Points for discussion
   - What are the causes of slums?
   - How can such a situation be improved?
   - Who should lead the campaign for improvement?

11.8.3 FOOD AND NUTRITION CASE STUDY 1 (Urban Zimbabwe)

This case study is hypothetical, and is given as an illustration only. Thus the names

of individuals used here are not real people though they may bear a resemblance. But the study uses realistic data.

We are looking at three heads of households earning a minimum wage of Z$88 per month. Their family sizes vary tremendously, a factor with great implications on the family's expenses for various items e.g. food, housing, clothing, recreation education and transportation while living in Harare, Zimbabwe.

Introduction

A healthy nation is reflected in the type of the average daily calorie intake for individuals in a given community. Internationally, developed countries have a per capita calorie intake of 2,500—3,000 per day, while developing country have less than 2,000 calories per capita daily. It is in the underdeveloped countries which have prevalent cases of malnutrition, marasmus and kwashiokor. In other words, the standard of living of any country's population could as well be measured in terms of the quantity and quality of food consumed by a family each day.

A hypothetical case.

Taking a hypothetical example of an average working person in a city we would assume that he needs three well-balanced meals, i.e. breakfast, lunch and supper daily.

CASE A.	CASE B.	CASE C.
CHIPOLE	SIKULE	LINDU

N.B. The $88.00 has to be shared equally by family members existing in the home. Case A Chipole will have the whole $88 to himself. Case B Sikule will have only $\frac{1}{6}$ of the $88 since he has a wife and 4 children. In case C Lindu gets only $\frac{1}{12}$ of the total share since he shares with 11 more people).

In Harare this average person would take breakfast with an egg, a bowl of porridge, a cup of creamed tea or coffee, two pieces of bread and butter/jam sandwiches for lunch and for supper he would have Sadza (Ngato) rice with meat and/or vegetables and fruit.

On the whole, this type of menu would guarantee our friend with four basic food nutrients; (1) proteins (2) carbohydrates (3) fats and (4) vitamins.
Let us assume that the average daily costs for an individual's food expenses total $7.50 a day ($1.50 for breakfast, $3.00 for lunch and $3.00 for supper). This means that our friend would require £225.00 to maintain a standard balanced diet.

The cases

Three friends work in Harare for the minimum wage of $88 a month. Their names are Athuman Chipole, 21 years old and a bachelor; Alfa Sikule is 40 years old, married, with 4 children; and 45-year old Allan Lindu is married with 10 children.
Athuman Chipole uses $16.00 rent, $10 for clothing, $12 for transport and recreation, none for education, and is left with $50 for food and other emergencies—see Figure 1. We can see that he is already short of $175, in order to eat a balanced diet. The other two friends Sekule and Lindu live in Harare, with their families packed-up in two rooms each.

● Sekule pays $30 for the rooms, and usually gives his wife $40 every month for food. He keeps the other $18 for other things. Sekule is married to a lovely wife Chitenge, and they have four children. Two of the children are already in primary school but the other are still too young to attend school.

● Life in the city is not all that easy for the Sekules and Chitenge uses all her home-economics skills to make sure that the money for food will carry them through to the end of the month. Many times a meal or two are missed each day in order to cut down costs. Many times food is mainly composed of a bowl of porridge for breakfast and sadza with beans for either lunch or supper. There are signs of malnutrition especially among the younger children. Mr. Sekule returns home late in the evening after drowning a plastic mug or two of chibuku.

This habit helps him to keep "cool" in the face of all the financial problems.
Mr. Allen Lindu, like his friend Sekule pays $30 for the two rooms his family occupies. He has a homely wife called Anna with 10 children. They are all in the city centre of Harare.

● Lindu spares $54 each month for the family food. Three of the older children cannot go to secondary school because Lindu lacks the financial ability to support them. They are all looking for petty jobs which are hard to come by. Four of the other children are in primary school, and the other three are still pre-schoolers.

Food is a problem with Lindu's family. They hardly can afford a meal a day, let alone getting enough sadra and vegetables at the table. Life is hard, Lindu cannot foot the bill for his children's clothing especially after paying rent. There is not a single month that he hasn't taken two or three salary advances just to make ends meet. The children carry all the signs of under-nourishment, poverty and disease. Lindu himself is more of a drunkard than a responsible father—and he cannot help it. If we refer to figure 1, each member of Lindu's family gets only $\frac{1}{12}$ of the case in case C.

EXERCISE

We saw in Case A that Chipole spent $50 on food as a single person and was short of $175 if he were to get a balanced diet every month.

1. Calculate how much money Sekule with 4 children and Lindu with 10 children need to have a balanced diet for a day, for a week and for a month respectively. Note that the average person needs $252 to maintain a balanced diet for a month.
2. The three friends are law-abiding citizens and want to maintain their good names in the neighbourhood. What advice would you give to each family head as you compare their income, food resources and the sizes of their families.?
3. What would each family head do to make the family survive through the other month?
4. Will each family be able to provide for the six life essentials: food, shelter, clothing, transport, education and recreation with a salary of $88.
5. What would you have advised the three friends on family care and responsible parenthood?

11.8.4 CASES STUDY 2

Planned Parenthood

Objectives:

1. To educate, motivate and inform people about the benefits of planned parenthood.
2. To inform people about the various contraceptive methods available.
3. To make people aware of the services available.

Family: It lives in a village, the mother is 30 years old they have 6 children aged between 1—12 years. They are subsistence farmers. The mother is always sick and this is compounded by the need to raise and take care of the family. The couple have never used any contraceptive methods.

One day a Community Based Distributor (CBD) from the family planning organisation visited their home. She found both the husband and wife present as well as some of the younger children.

The C.B.D. greeted them and introduced herself to the couple. She told them about the purpose of her visit and the role of the Family Planning Organisation. At the same time she took note of the state of health of the family. She started off by telling the couple that traditionally, people have used various methods of family planning e.g. withdrawal, polygamy, beads, etc. She went on to state that modern methods which are more effective have been developed.

The man was very much opposed to interference in his family life. He said he wanted as many children as possible to perpetuate his family name. The CBD explained the advantages of child spacing to the mother, child, father and the rest of the family. She emphasized the health benefit to the mother, child and the family. She also pointed out that children have to be provided for—they need to be properly fed, clothed, housed and sent to school.

The man also was worried that should his wife take the pills, etc. this might be a licence for her to go out with other men. The CBD explained that promiscuity is a problem of society whether one uses the pill or not. It depends on the individual. After some discussion the couple accepted to adopt one of the family planning method-the pill. The CDB went on to take the medical history of the mother—BP etc. The woman was only given one packet of pills and asked to go to the clinic at the end of the month where she would be examined and given more packets if appropriate. She went on to explain how the pill involves some of the side effects and how they could be managed.

It was emphasised to the family that family planning meant the couple decides on the number of children they want, when they would like to have them etc. In other words, children need to be planned for in advance. The mother needs to be given time to rest and restore her health in between the births. Children themselves require material support from the parents in addition to the satisfaction of their basic needs.
By the end of the talk, the couple had realised that they had more children than they could provide for. A follow up visit was arranged within 3 weeks.

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12

THEME IV

URBAN/INDUSTRIAL DEVELOPMENT

12.1 INTRODUCTION

12.1.1. Problem Perspectives

During the last twenty years, many African countries achieved political independence without concomitant levels of economic independence. There has therefore been a striving for economic self-reliance, and a search for the most effective strategies that will produce real economic growth as an indispensable element in national development. Third world countries are presented with various development options but most African countries have opted for varying degrees of industrialization. Associated with this option is the consequent development of large scale urban settlement.

Large scale development of industries and urbanisation, mass migration of the rural population to urban areas in search of work, and the explosive increase in population have created serious environmental problems. In many cases, a large percentage of the urban population lives in slums, without the basic sanitary facilities or lighting. The absence of essential services like safe disposal of human and other wastes results in frequent epidemics, and has threatened the general health and well-being of the large mass of people who have come to town in search of work. Such sub-standard living conditions in many urban areas have raised serious problems of public health, and created many difficult social problems.

Industrialisation as practised by most African states is strongly patterned after that of the developed countries. Until recently, environment has never been the target of foreign interests or the wealthy social groups of African countries; the concern for the environment has therefore evolved as an indirect result of decisions made primarily with reference to other issues. This pattern of development cannot be allowed to continue if the hazards and pitfalls of industrial development in developed countries should not be replicated in developing countries.

12.1.2. Rural-Urban Migration

Migration is the chief cause of rising levels of urbanization in most parts of Africa today. This is caused, in main, by differentials, or the perceived differentials between the rural and urban areas. The following reasons have been given to explain the causes for the drift to the urban areas:-

(a) conditions of deprivation in rural areas, frequently including a lack of basic amenities such as piped water supply and electricity;
(b) periodic crop disasters;
(c) more dynamic growth in the towns;
(d) greater possibility of full-time or part-time employment in rapidly growing urban areas, as well as opportunities for all types of employment in the informal sector;

THE CITY SYSTEM: INPUTS AND OUTPUTS

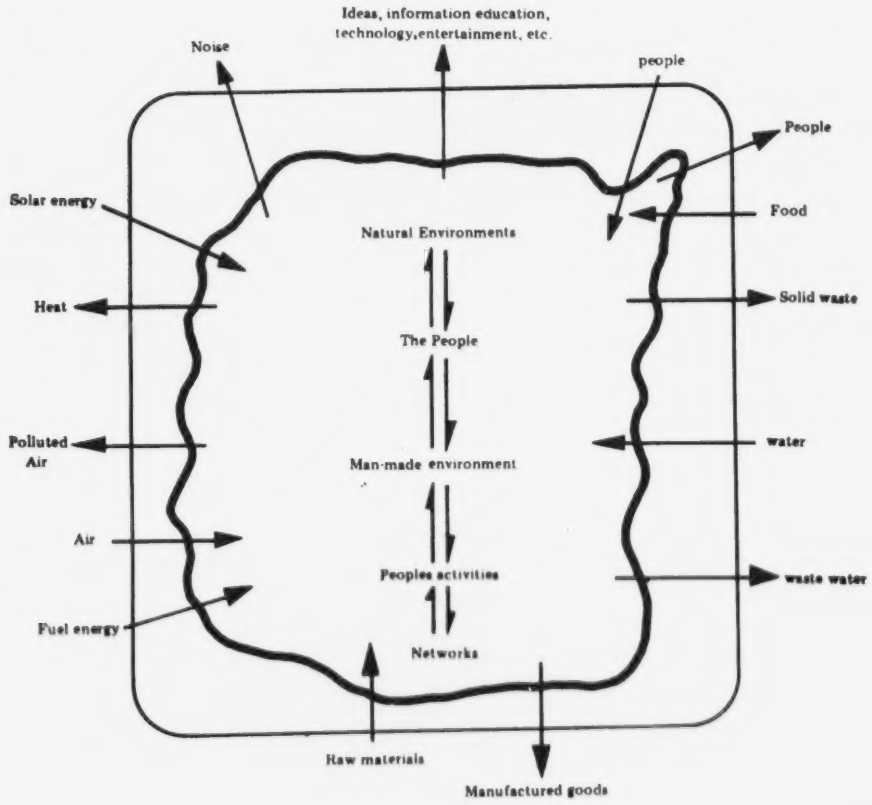

Fig. 41: *Urban/industrial development.*

(e) social emancipation, particularly for the younger generation, offered in the urban areas;
(f) opportunities to join relations in urban areas who have previously migrated from rural areas (many migrants prefer even the life of a squatter to the conditions of isolation and deprivation that prevail in rural areas);
(g) recreational and educational opportunities in urban areas, even for squatters;
(h) a desire to be part of the consumer society in urban areas.

Uncontrolled migration has resulted in the existence in urban areas, of shaks, shanties, sheds, stalls and all types of slum areas. These are characterised by overcrowding, deterioration, insanitary conditions or absence of amenities, and endanger the health, safety and morals of the community. These habitations are often in bad repair, damp and unhygienic. They lack adequate municipal and social services, are subject to fire and flood hazards, and are associated with child delinquency and crime, contagious and chronic diseases and high infant mortality. Slums commonly include locations consisting of unauthorized and insanitary huts put up by vagrants and homeless people on vacant land.

In the formative years of industrialization, the slum is an inevitable by-product of urban development, with the factory becoming the new urban organism. The process of accelerated urbanisation, when combined with the industrialization process, the general scarcity of resources, and with the usually highly uneven income distribution, causes very serious environmental problems.

Fig. 42: *A shanty dwelling.*

12.2. THE URBAN ENVIRONMENT

12.2.1. Urban Systems

There are at least two senses in which the term urbanisation may be used: on the one hand, it commonly refers to the concentration of formerly dispersed populat-

ions that are primarily engaged in agriculture in a number of small settlements whose main economic activities are in the services, trades and manufacturing. On the other hand, it refers to urban modes of production, living and thinking originating in these centres and spreading to outlying towns and rural populations.

Although cities may be studied individually, they form part of an urban system involving considerable interaction within the system. These systems extend not only across national boundaries, but also internationally, through the flow of people and goods. Within national boundaries, an urban hierarchy can be identified as consisting of a system of many small centres which perform a similar limited range of functions and which depend on fewer larger centres for more specialized functions. These national systems are generally dominated by a single primate city, the numbers of which have tended to increase in recent years. The high rates of urbanization which has contributed so dramatically to the growth of primate cities is the result of high rates of natural increase coupled with increasing rural-urban migration. The level of urbanization however, has remained generally low. Tropical Africa's urban population is rising by over 5% per year, and in many cities, by over 7% per year to produce a doubling in 10 years.

Table 1

Estimates of migrants as percentage of population increase

City	*Period*	*Total population increase (Thousands)*	*Migrants as a percentage of Total Population increase*
ABIDJAN	1955–63	129	76
LAGOS	1952–62	393	75
NAIROBI	1961–69	162	50

Source: BERRYL J.L., *The Human Consequences of Urbanization.*

Land use studies describing the morphology of African cities have consistently reported the existence of a "dual city". Two major types have been identified:-

(a) In areas of Africa with a strong pre-industrial urban tradition, the modern and traditional are clearly deleanated in space. The major West African cities provide examples of this phenomenon.

(b) Cities built during the colonial period, where no previous urban experience existed, no clear "old city" is evident, but the low income indigenous people live in high concentrations in the older parts of the city and on its fringes.

Table 2

Extent of uncontrolled peripheral settlements

Country	*City*	*Year*	*Population (Thousands)*	*Uncontrolled Settlements Total (Thousands)*	*As a % of city Population*
SENEGAL	Dakar	1969	500	150	30
TANZANIA	Dar-es-Salaam	1967	273	98	36
ZAMBIA	Lusaka	1967	194	53	37

Source: BERRYL, B.J.L., *The Human Consequences of Urbanization.*

12.2.2 The Concept of Urban Stability

This concept refers to the potential capacity of a country to continue to urbanize, given the size of its population, its level of economic development, the pattern of demographic growth, and the current balance between rural and urban residence. For example, a relatively industrialized country (such as Argentina in Latin America) with a relatively high per capita income, low birth rate and a high percentage of its population already urbanized, can be termed 'stable', whereas a country like Upper Volta with low per capita income, high birth rate and a high proportion of its population still rural would be classed as 'very unstable'.

The historical configuration and the growth rhythms of the urban settlements determine the way the land is used and sub-divided, and influence the character of the resulting environment problems:

(a) Extreme densities, high as well as low, as a result of the uncontrolled operation of the land market;

(b) Overcrowding and inadequate dwellings;

(c) Scarce supply of infrastructural services and collective facilities;

(d) Pollution of surface waters as well as of those in the upper phreatic layers;

(e) Air pollution;

(f) Increasing deterioration of the natural landscape.

The rapid growth of large cities, controlled only by the operation of the land market, means that a considerable proportion of the population live in areas with very low densities. Due to these low densities, movement to and from jobs takes a long time. On the other hand, community facilities and infrastructural equipment restricts the extent to which they can be made available to this category of the urban population.

12.2.3. Socio-economic Considerations

The size and growth rates of urban centres may be considered as manifestations of a social process, and of the material conditions in which this process takes place.

The urban environment is created by the investments (or lack of them) that are allocated by both the public and private sectors. The investment capacity of these two sources accounts not only for the general characteristics of the urban environment, but also for its internal differences, i.e. differences in the economic and political capacity of the various social groups living in the urban settlements influence the physical characteristics of the space they occupy.

In a situation where public investment is not sufficient to meet the needs of the population for basic services (such as piped water, sewerage, rain water drainage, road network, electricity, garbage removal and education), the factor of social class becomes important. Some public services are provided mainly to favour the highest income sectors of the population, as is the case with the road network. These sectors have the economic capacity to create for themselves an environment suited to their needs. To this end, they choose the most advantageous locations from the point of view of the natural conditions of the site, such as a latitude, quality of water and landscape quality.

From the environment point of view, the most serious problems that faces these high-income sectors is *air pollution* caused by the combustion of automobile fuel, the use of domestic incinerators and traffic congestion. The lower-income members of the population on the other hand, live in the poorer environmental conditions, due to their lack of economic means and the limited public investments allocated to their areas of the city. The land to which they have access usually is located in the urban periphery (often low-lying areas), and lacks piped water and sewerage services. Physical accessibility is also inadequate, since the paved road network seldom extends so far. To these problems must often be added those caused by periodic flooding which makes the unsurfaced streets impassable during certain seasons of the year. The lack of proper rain water drainage makes the situation even worse.

Apart from social differences, other factors affect the manner in which the process takes place. These include the site where the urban centre is located, the way the land has been subdivided, the plot sizes and shapes, the road network, provision of services, the *location of industries*, and the densities and construction patterns adopted for the residential areas.

Natural resources and climate also influence the type of environment found in African cities. Both these factors are, however, themselves greatly affected by the *TECHNOLOGY* used in the creation of the built environment. This, in turn is related to the investment capacity of the public and private sectors of a particular society. This technology determines the form of the agglomeration. With the same amount of investment, different environment results can be achieved through different technological approaches, but the choice of technology tends to be regulated by cultural forms.

Technological development thus affects the urban environment in two ways:
(a) through construction and industrial activities; and
(b) through the population's propensity to consume goods and services.

The *pattern of consumption* of the population, and the normal lack of adequate controls, contribute to *increase the level* of pollution. For example, the use of automobiles increases air pollution; non-degradable detergents produces serious water pollution, in a broadly direct ratio to the size of the population and its economic capacity.

Technology is both a principal *cause* of environmental deterioration and a main *resource* in efforts to improve environment. The real problem is that the available technology for improvement is usually related to the economic level of the developed countries, and consequently may be unsuited to the economic capacity of developing countries in Africa.

Questions for Discussion

1. What are the factors which contribute to rural urban imbalances in your country? To what extent is migration from rural to urban areas a problem?
2. Is urbanization a problem in your country? If so, how is the living environment in the urban setting affected by these problems?
3. What programmes exist in your country which are geared to:-
   (a) rural development, and
   (b) the needs of the urban poor?
4. It is said that one of the problems of uncontrolled urbanization is the erosion of cultural values leading to severe social problems. What are the manifestations of these problems in your country?
5. In what ways can adult education or community education contribute to the solution of problems which have been highlighted in this chapter?

12.3. THE INDUSTRIAL ENVIRONMENT

12.3.1. Industrial Framework

Industrial activity is an integral part of the process of development. Traditionally, industrial growth has led simultaneously to the manufacture or production of goods for society, and to the provision of employment for a large mass of workers. In this respect, the development of industry is considered synonymous with improvements in living standards.

Industry can generally be classified in the following way-:

A. PRIMARY INDUSTRY is the simplest form of industry which consists of the first processing of raw materials, e.g. the production of metal from mineral ores. Primary industrial activities are carried out in the fishing, forestry, mining and agricultural sectors.

B. SECONDARY INDUSTRIES cover a wide range of operations which include all re-processing of partially manufactured goods to make more complex products e.g. the use of iron in machinery. These industries are sometimes divided into:-
   (i) Heavy industry: e.g. engineering, shipbuilding, chemical, etc.
   (ii) Light industry: e.g. electrical equipment assembly, textiles, plastics, etc.

C. TERTIARY INDUSTRY is not a branch of manufacturing, but consists of service industries such as personal service, trade, transportation, etc.

It is necessary to consider the industrial scene as it exists in the different present policies, as outlined in various documents:

Industrialization in Africa is at its infancy when compared to the rest of the world. This is manifested when one considers that it is even struggling to maintain its 0.7 % share of the world industrial production; the industrial growth rate in the 70's was only 5 % and there has been no drastic change recently. The continent would find it difficult to meet the 2 % of world production by the turn of the century as predicted by most planners. The industrial scene of Africa is still plagued with low levels of productivity, excessive dependence on agriculture, a small range of primary export commodities, a transport network geared towards the export sector and predominance of expatriate staff in all the key areas of management. These conditions are mainly caused by the fact that colonial patterns of production in Africa were oriented towards export market with little regard for the socio-economic development of the continent. They are essentially producers of raw materials that are open to erratic demand patterns and price fluctuations. In essence, they supply the raw materials to the developed countries at low cost, where they are processed and exported back to Africa at a very high cost. In fact within Africa, the import-export trade has more transport links with their colonial masters than with other African countries.

Against this background, the industrial scene is dominated by subsidiaries of multi-nationals, transnational corporations and small scale interests from the developed world. The structure of these industries is undiversified, consisting mainly of mining, import substitution industries and some other agro-based industries. Mining sector is limited to the export of the raw materials with little or no processing being carried out locally. Most of the minerals mined are iron, copper, bauxite, diamonds and petroleum. The other industries consist mainly of food, beverages, textiles and tobacco products. Though wood is one of the great resources of this continent, yet still this industry is not well developed in most countries. Most of these industries have limited production facilities, reflecting the internal demand intensities. However, there are now certain countries that are moving towards the use of sophisticated technologies and diversifying from the traditional lines already mentioned. Electronic machinery, mining, chemical and most science intensive industries are known to contribute significantly to economic growth; but African countries are now forced to concentrate on agro-based industries in order to achieve self sufficiency in food and also utilize the abundance of raw materials available. This strategy will assist to change the trend of "producing what you do not consume and consuming what you do not produce"

Most of the industries started before independence have remained under foreign control. The new ones that came after independence were established under the concept of transferring technology from the north to the south, with controversial results. As a development option most African countries accepted the affiliates of big multi-nationals and transnational corporations (TNCs). They became very attractive because of their enormous capacity for mobilizing large-scale

financial resources and deployment of specialized technological and managerial skills. Their investments are directed in areas that will ensure good prospects for production in world market, and availability of suitable labour on advantageous terms. For transfer of technology to be effective, the recipient country must have the absorptive capacity for the technology in terms of infrastructure, manpower, support, systems, and Research and Development capacity; these are non-existent in most African countries. Hence most of these countries never gain from the transfer of technology as handed over from the north to the south. They never realized that techonology is for sale in the world market just as many other commodities and that it is the buyer who should be careful. The resulting situation is that for most countries, technology has not been transferred because the owner of the technology has to protect its interest. In most cases the TNCs have successfully displaced the efforts of local producers by using special marketing techniques and intensive advertising tactics. The preference for foreign brand names generally experienced in African countries due to colonial experience/ tradition does not help the situation. Altering this trend will require substantial changes in policy and policy instruments and also a creating of code of conduct for the TNCs.

It is however gratifying to note that most of these points have been realized by the various countries and with the help of the United Nations Centre for Trade and Development (UNCTAD) established in 1975, they are now negotiating a code of conduct for TNCs in developing countries.

There is also both internal and external factors that impede the wide spread industrialization as hoped for by the African countries. The present industrial activities in the agricultural sector which provides living for most Africans are still unmechanised, resulting in low output and exposure to natural disasters such as drought, pests, earthquakes, floods etc. This has resulted to an atmosphere of insecurity of supply wich affects industrial expansion and incentives.

Also most African countries are not prepared to sacrifice their drive for foreign exchange receipts from exporting raw materials and the development of processing facilities. This is a dilemma for the countries who want to industrialize. Another internal factor is that the industries are largely urban-based, and are fed with raw materials from the rural areas. The existing infrastructure in terms of roads, railways, etc. is very poor and inadequate. The most important external factor affecting the prospects of industrialization is the energy crisis and its effect on the prices of the imported goods needed by the African states. Due to the low income of inhabitants of these countries, foreign finance remains to be the main contributor to industrial development and since this area is contracting due to recession in the donor countries, industrialization prospects have to be curtailed. The growing protectionism by the developed countries which mainly takes the form of either direct import restrictions or market restrictions in the areas in which developing countries can succeed only strengthens the unfair international trading that exists. Another factor that promotes this present trend is the fluctuation in the price of commodities and also the absorptive capacity of the developed countries for the exports from developing countries.

rage systems. *Chemical industries* are generally the worst polluters. The concentration of textile processing units particularly in smaller urban centres, has resulted in damage to surface as well as subsurface sources.

The environment needs to be considered as a *resource and* and the damage to it should constitute a cost to be borne by industries as well as society. Therefore, industrial location, even for small-scale industries deserves careful consideration as regards possible pollution and the possible incorporation of treatment facilities at a stage prior to final discharge of wastes.

Fig. 43: *Chemical industries are generally the worst polluters.*

Economic and efficient management through the *re-use and recycling of solid and water wastes* should be encouraged. Industries with complementary pollution and with environmentally interacting processes should be encouraged to locate together but decisions would have to be based on careful identification of pollutants emitted.

Many urban centres are situated on non-perennial rivers so that complete or tertiary treatment is needed to dispose of final effluents into receiving bodies. Nutrients must be returned to the soil, and water to irrigation uses. The re-use of waste water necessitates the introduction of *recycling concepts* and demands experimentation leading to minimization of treatment costs. Solutions to the problems of solid-waste management are subject to many constraints. The nature of the waste, climate, hygiene, living conditions, and social religious, economic and other factors are specific to individual countries and need indigenous solutions. Industries located in congested metropolitan areas which share no treatment facilities with the city often lack disposal sites such as streams or waste land. This results in the spread of treated effluents around factories. Special standards for treated and monitored effluents need to be evolved for disposal underground to form artificial recharge systems. Sophisticated concepts of solar evaporation for small volumes (e.g. 10 m^3 per day) of highly concentrated waste water deserve implementation and propagation.

The protection of the industrial environment cannot be ensured by persuasion alone; it must be supported by legislation, which must be implemented by monitoring and surveillance agencies. Tax penalties (where they exist) are transferred in large part to consumers with little impact on the profits of industries; social controls need to be incorporated in the form of tax rebates for recycling of waste water.

While *public involvement* is a means of bringing about community awareness and dialogue of the likely effects of a development decision, *participation* has the added advantage of making the public bear some responsibility for the decision.

It must be noted that environmental impacts will eventually reverberate on the public itself, whose right to know will become increasingly important and demanding as *appropriate education* takes root within the community.

Table III

Major Industrial Sectors in Selected Countries in Africa

COUNTRY	*MAJOR SECTORS*
Burundi	Beverages, clothing, metal, food.
Cameroon	Food, non-ferrous basic metals, beverages.
Congo	Beverages, tobacco, petroleum refining food.
Egypt	Textiles, food.
Ethiopia	Textiles, food, beverages.
Ghana	Petroleum refining, beverages, food, non-ferrous metal.
Kenya	Food, transport equipment.
Libya	Tobacco, food, other chemicals.
Madagascar	Food, beverages tobacco, textiles,
Mauritius	Food.
Mozambique	Food, textile.
Nigeria	Textile, beverages, food.
Rwanda	Food, beverages.
Somalia	Food.
Zimbabwe	Food.
Sudan	Textile, clothing, food, beverages.
Swaziland	Wood, furniture, food, beverages.
Tanzania	Textile, food.
Togo	Textiles, beverages, food.
Tunisia	Food, industrial and other chemical products
Zambia	Beverages, tobacco, food.

Source: INIDO. *Recent Industrial Development in Africa* (UNDO/ICIS.) August, 1979.

Table IV

Some Basic Indictors of Industrialization in the West Africa Sub-Region

Country	*Population (millions)*	GNP *Per Capita (Doll)*	GNP *Average Annual growth rate % 1960–80*	Values added in manufacturing *Total (millions of dollars)*	Values added in manufacturing *Per Capita (dollars)*	Values added in manufacturing *Average Annual growth rate 1960–80*	Values added in manufacturing *Percentage of GDP 1976*
Nigeria	84.7	1010	4.1	2395	31	10.4	9.8
Ghana	11.7	420	−1.0	1973	195	3.0	24.8
Liberia	1.9	530	1.5	36	22	12.2	5.3
Sierra Leone	3.5	280	1.5	30	10	2.3	N.A.

It must be noted that Nigeria and Ghana are classified as industrializing countries while Liberia and Sierra Leone as non-industrialized countries when considered in global terms.

Source: 1. World Development Report 1982.
World Bank publication.
2. Helen Hughes "Industrialisation and Development"
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12.3.3. Two Examples

(A) *Dam Construction*

The construction of large dams for hydroelectric power is very attractive to most African countries, especially when considered as an alternative to combustion of petroleum derivatives. These large dams cause severe environmental problems such as the loss of agricultural land, displacement of inhabitants, the development of waterborne diseases, and change in the eco_ structure.

Some of the negative effects due to the construction of large dams in Africa are shown below:

(1) It is estimated by Falkermark and Lindi in the book "Water for starving world" that over 61,750,000 acres of productive land has been destroyed all over the world and 741, 000 acres yearly due to the construction of dams.

(2) The Volta dam in Ghana has displaced approximately 80,000 people and before construction there was only a low rate of bilharzia and river blindness occurrence, but after the construction, 1966, 10% of children between ages of 10 and 15 were affected. This affects the agricultural production of the country and dislodges the peasant farmers. Also site clearing can cause severe losses to both plants and animals which are of economic value. Access roads created by the various operations within the mine, mostly not tarmac, can cause a lot of inconvenience to the environment. Soil erosion is one of the unavoidable aspects of mining, but this can be minimized. Run-off water which is always in large volumes are usually acidic, and poses a serious problem. Water treatment and storage/dis posal should always be considered in planning a mine. The water regime in an area can be affected adversely by underground mines. Dust generated from the mining site, storage and transportation and noise from various operations such as blasting, can cause severe health problems. Plant diseases have been found to occur around mining operations.

Questions for Discussion

1. What are the principal industries in your country? Are there any environmental problems created by these industries?
2. Are there any well defined industrial policies for your country which take fully into account the environmental consequences of this type of development.

3. What are some of the measures which have been taken (a) nationally, (b) at the community level to reduce environmental pollution arising from industrial and/or urban development?
4. In the light of the circumstances of your country, what (a) in the short-term, and (b) in the long-term would you consider the best development strategy, agricultural or industrial development?
5. What in your opinion, would be the role of Adult Education in preparing people for effective participation in rural/urban development?

12.4. URBAN/INDUSTRIAL STUDIES IN THE ENVIRONMENTAL EDUCATION CURRICULUM

12.4.1. Instructional Objectives

The objectives of teaching/training adults about environmental problems and issues related to urban and industrial development fall broadly in line with the aim of producing environmentally literate and competent Africans who will be able to acquire the following capacities and behaviours:

1. To know about, understand, and become aware of the problems and hazards that are associated with unplanned urbanization;
2. To examine the problems and circumstances which lead to the rural-urban migration, develop positive attitudes towards the rural environment and generate commitment to the challenges and opportunities for rural development as a means towards halting the drift to the urban areas;
3. To acquire knowledge and understanding of the problems connected with the urban environment and generate skills for dealing with, and participating in, pollution abatement measures;
4. To study the factors which influence the process of industrialization in (specific) African countries, and understand the implications of that process for individual countries;
5. To examine the environmental impact of specific relevant industries;
6. To acquire the necessary knowledge, skills and attitudes which are required to deal with the environmental problems created by industrialization (a) at the personal level, and (b) at the community level;
7. To develop positive attitudes towards the environment and generate commitment to actions which will ensure its protection, preservation and enhancement of its quality.

12.4.2. Strategies for reaching these objectives

The strategies used must correspond to the nature of the adult learner, his mature status and self-respect as an adult. To that extent, instruction must be experience-based, and the teaching/learning strategy must employ the problem-solving approach, giving adequate opportunity for the learners to discuss freely the issues under consideration, and making effective use of the learners latent knowledge and experience. Practical methods which allow for the adults' full participation must be used in the attainment of the above instructional objectives. Additionally, the following aspects of the strategies should be effective:

(a) For sensitization and achieving awareness, use must be made of available mass media, e.g. radio, television, printed material, face-to-face communication, symposium, debates, discussions, role-play, etc.;
(b) Organisation of educational and/or training programmes at the community level for both young and old, using non-formal approaches, supported by appropriate communication media;
(c) Organisation of Workers Education Programmes in both the Urban and Rural settings, with emphasis on, and examples from the world of work, and the environmental problems therefrom;
(d) Field Trips (a) to an industrial centre, e.g. a mine, a workshop or factory, to learn about the actual working conditions, and (b) to a slum area, to illustrate problems arising from rapid unplanned urbanization, these are followed by group discussion and a summing-up of the learning experiences.
(e) The Establishment of Data Collection and Information Centres (e.g. in Institutional setting, Community Education Centres, Industrial/Factory Establishments, etc.) which provide available materials and resources connected with environmental problems related to industry and urbanization.

12.4.3. **Sample Curriculum Content**

The following curriculum outline is in conformity with the objectives and strategies of instruction for environmental perspectives on urban/industrial development:

(1) An examination of the rural-urban imbalances which result in migration from rural to urban areas; national perspectives;
(2) The problems of urbanization and the living environment; the diversity of urbanizing situations in the socio-economic and political contexts;
(3) Water supply, shelter and sanitation needs of urban areas. Technological aspects of urban environmental improvement;
(4) Simple examination of the basic features of the country's economy, including the way in which industrial projects are financed; problems associated with industrial development;
(5) National Priorities—including a study of national development plans as related to industrial development and the environment;
(6) The structure of industry, including the scale of operations, and possible hazards in their production processes;
(7) Environmental problems due to the industrial processes, the social political, economic and ecological impact on the society due to these problems;
(8) A study of the relationship between urbanization and industrialization;
(9) Corrective measures to tackle the various environmental problems outlined;
(10) Monitoring industrial operation in order to identify possible hazards to workers;
(11) Examination of the legal framework with respect to industrial operations as related to the environment;
(12) Environmental education for (a) the urban population, (b) industrial workers, and attending to the needs of the urban poor.

2.4.4. In the Context of Adult Education

- Within the perspective of environmental education, adult education should provide programmes for generating awareness and understanding of the environmental problems and issues of the urban areas;
- The socio-economic causes of urban poverty, and its effects on the social and cultural life of the community should be analyzed, and included in training programmes for Adult Educators;
- Functional literacy programmes should be developed for the ignorant, illiterate and unemployed, to provide basic knowledge and skills for self-reliant existence and self-employment possibilities in the non-formal sectors of the economy;
- Adult Education should also develop programmes for the general public, dealing with the role of industrial development, the benefits and limitations of the urban/industrial interaction, and the problems within the industrial environment;
- Specific courses for workers, in particular functional groups within the urban environment should be designed so as to provide an awareness and understanding of the environmental problems and issues related to the particular occupational tasks.
- Adult education should stimulate public discussion on environmental issues of contemporary concern, through radio programmes, newspaper articles, films and filmstrips, and through 'cities and civic exhibitions'.

2.5. RESEARCH PERSPECTIVES

Considerable research has been done on urban industrial development and the environment, especially in the developed industrialized world. It would seem that relatively little has been done which addresses specific issues related to the African continent in this respect. The following area critical areas for possible research in the African setting:

(1) An analysis, within a developmental framework, of the socio-economic causes of urban poverty and Nair effect on the social and cultural organisation of some African Communities;
(2) An assessment of the extent to which environmental considerations constitute a significant factor in African development planning and implementation;
(3) A detailed study on the clauses in existing industrial contracts regarding environment and possible linkages, as a significant index for policy guidelines and formulation in this area;
(4) Evaluation of environmental problems in existing industries, including health of workers and inhabitants in the immediate environs;
(5) Study of corrective measures for possible hazards due to the various environmental problems in various industries;
(6) Study of various methods of monitoring industrial operations with the hope of identifying the level and extent of environmental problems associated with such operations.

12.6 CASE STUDIES

A Case Study from Zimbabwe

Epworth Urban Upgrading Programme

Subject Paper No. 2 Socio-Economic Characteristics of Residents

Summary

At the outset of the upgrading programme in Epworth, very little hard data was available concerning the resident population. On the basis of two surveys conducted by this Department with the assistance of the Central Statistical Office in December 1983/January 1984, a number of sound facts have now been devised on which to base policy formulation and planning solutions.

The total resident population is now known to stand at 25,200 people with an average of 7.2 people per stand. A high 39% of heads of households are lodgers compared to 55% of heads "owning" their stands.

Although there is obviously a wide cross-section of people in Epworth, average resident households are poor in comparison to typical households and are completely dependent on gifts and remittances from relatives, pensions, rent or self-employment of some kind. 13% of households have no member of their households active in any form of employment at all. Of the 75% of households who have one member (only) employed, 32% of these workers are employed in the very low income fields of domestic services, agriculture and mining.

This information on incomes is also borne out by attitudinal questions which revealed that a majority of residents live in Epworth because of the high rents charged in the high density suburbs and had moved to Epworth from other parts of the city as opposed to directly from rural areas. There is of course, also the group of residents who were born and lived all their lives in Epworth.

Background

A housing programme encompasses more than the provision of individual shelter; it considers the housing environment as a whole and the part that this environment plays in peoples' lives. This realistic approach calls for information on the characteristic of the users; being planned for, where do people work, where do they do their shopping, where do they go to school, how do they spend their leisure time.

Answers to all of these questions affect planning considerations such as the transportation corridors through an area, what types of health, educational and commercial facilities, should be provided and where, crime prevention designs, and similar.
In the Epworth programme (as in all the country's housing supply programmes), the principle of total cost recovery is being applied. Therefore residents of Epworth will be expected to pay (over a 20–30 years period) for the provision of a water supply, roads, home improvements and similar.

Two possible solutions to the "Epworth problem" have presented themselves. On the one hand, a strategy might be adopted to improve the physical appearance of Epworth—tar the roads, introduce piped water to every house, provide electricity and so on. In that the average stand size of Epworth is 10 times the sizes of stands in high density areas, such strategy, whilst technically possible, would be extremely expensive. The odds are high

that if such a strategy were adopted only a very small minority of present Epworth residents would be able to afford the repayments on such services. The rest would be "squeezed out" and probably rebuild elsewhere in the city. Thus the problem would not have been solved but merely relocated.

The alternative strategy would be to plan *with* the residents of Epworth rather than merely beautify the physical appearance of the area. This is the strategy that has been adopted by the planning team. It recognises that the goal of providing adequate services and a decent housing environment of Epworth must be carefully phased in on the basis of residents' incomes, and expenditure patterns of households is crucial to the phasing in of such a strategy. Finally, it must be noted that the development of Epworth envisages more than the mere physical and infrastructural upgrading. It also includes the development of human potential in the area, and working towards fulfilling social and personal needs and aspirations of the residents. For this purpose also, more qualitative and attitudinal data are required to assist community workers in the area.

For these reasons there, the Department of Physical Planning mounted two comprehensive surveys in December 1983/January, 1984.

HOUSEHOLD SURVEYS

1. Pre-Registration Survey:

The pre-registration survey had four objectives:—

(i) To have an accurate head count of the number of people living at Epworth. The 1982 National Census enumerated some 18,000 people living at Epworth, yet the Mission authorities claimed almost double this figure-some 30,000 people.

(ii) To have a record of the names of heads of households and stands owners and where they lived to cross-check future lease applications.

(iii) To provide a baseline of information on which to draw a reliable sample for a more detailed household income expenditure survey. This baseline data could also be used for future monitoring of the upgrading programme.

(iv) To collect some information for future components of the upgrading programme (for example, issuing stand numbers and identifying stand boundaries for lease purposes, basic information on the quality of the built house).

The housing extent in Epworth was broken down into 8 areas, each of which in turn was divided into segments of approximately 100 stands each. Every stand was then numbered accordingly and its position noted on the May 1983 aerial photograph. Stands developed after May 1983 were also given numbers so that they might be identified at the time of issuing leases.

A questionnaire was then administered to every single household on every single stand at Epworth. At the time of writing 96 % of stands had been covered.

It is not intended to discuss the results in detail here. However, a number of points arising from these totals should be noted:

(i) The data, aggregated as it is, tends to obscure the diversity found in Epworth. For example on average, there are 7.2 people living on every stand. However, in Muguta Extension one finds only 5.5 people per stand and in Muguta one finds on average 13 people per stand and in some individual cases 40 people per stand.

(ii) There is large number of lodgers staying in Epworth in common with high density/low income residential areas. 39% of heads of households are lodgers. Although it has not come through in the data, lodgers are an obvious means of low-income families supplementing their incomes.

(iii) Epworth households have a high incidence of unemployment (at least 9%) and over a third of households depend on wages from the low-paid domestic, agriculture and mining sectors. This confirms a previous, limited survey (carried out by M. Mock Smith) which showed that Epworth households earn approximately £90 per month compared to households in high density areas who on average earn £160 per month. Undoubtedly people have moved to Epworth because they could not afford the monthly repayments in the high density areas.

2. **Household Incomes/Expenditure Survey:**

The objectives of this survey were:

(i) To gain more quality of life of residents at Epworth, for example mortality rates, ownership of bicycles, radios and similar thing, distances walked to get water, etc.

(ii) To gain some attitudinal as regards why families moved to Epworth, where they came from and why they liked or disliked Epworth.

Epworth urban upgrading programme: preliminary results of the registration survey—area total

1. Average number of persons per stand	7.2
2. Average number of households per stand	1.7
3. Status of heads of households:	
— Owners	55%
— Main tenants	3%
— Sub-tenants	0.9%
— Lodgers	39%
— Others	2%
4. Number of persons per household working in the last seven days:	
— 0	13.4%
— 1	75%
— 2	9.4%
— 3	2%
— 4	0.5%
— 5 and more	0.2%
5. Major source of income:	
— Agriculture	0.5%
— Other household enterprises	0.1%
— Wage/salaries	75%
— Self-employment	13%
— Rent	0.8%
— Gifts and remittances	8.3%
— Pension	0.6%
— Other	1.1%

6. Major economic activity:

— None	9%
— Agriculture	2%
— Livestock	1.4%
— Fishing	0.7%
— Mining and quarrying	1.6%
— Manufacturing and industry	20%
— Electricity, gas and sanitary services	2.4%
— Construction	8.3%
— Trade, vendors	11%
— Business and finance	1.1%
— Public administration, defence	9%
— Social services	2.5%
— Recreation and cultural services	0.5%
— Domestic services	26%
— Repairs	1.7%
— Others	2.8%

7. Total Population = 25,200 people

8. Total Number of Stands = 3,800

(iii) To obtain detailed information on household incomes which could be used in deciding on levels of services to be provided

From the pre-registration survey information high density segments and low density segments in Epworth were delineated. Using random sampling, 150 stands (4%) were selected for more in depth study.

Three questionnares were then administered to each household living in these stands. The first survey pointed to a high percentage of unemployment and informal sector employment amongst Epworth households. It was agreed that questions on income would either be avoided or be difficult to answer because it is variable from month to month. To overcome this problem, every adult in each of the sample households was also provided with a record book. With the assistance of enumerators, daily expenditures, however small, were recorded for two weeks. In this way conclusions as to how much money is being spent on what types of items, could be made.

At the time of writing, all the data from the second survey has not been completely collected.

However, some preliminary conclusions can be made:

(i) **Quality of life indicates:—**

- 63% of respondents use unprotected well for all domestic and gardening purposes, 8% unprotected stream water and only 16% a protected well.
- 94% of respondents use an unimproved pit toilet and only 5% use a ventilated improved pit toilet.
- a fairly high 14% of heads of households are women.
- 44% of respondents own a radio. 33% a bicycle and 4% a motor car.
- 80% of heads of households are aged between 25 to 60 years, but a high 21% are older than 60 years.

(ii) *Attitudinal data:—*

— 6% of the respondents were born in Epworth, but the majority (86%) have moved to Epworth since 1980.

— 74% households lived in Harare before coming to Epworth (41% came from the high density areas, and 33% from the low density areas.) Of the 41% of respondents who came to Epworth from other parts of the country, 76% came from commercial farming areas (presumably because they had lost their jobs).

— 84% of all respondents came to live in Epworth and like living there because accommodation is affordable and cheap. 54% also liked Epworth because it is close to town and employment. Other positive conditions at Epworth are the large size plots which permit agriculture and growing vegetables, (mentioned by 10% of respondents).

— 98% of all respondents are not on a waiting list for housing in any of the City's high density areas; 56% felt that other housing was too expensive and 10% that the waiting lists were so long it would be pointless. The rest said that they liked staying in Epworth.

(iii) *Household Income and Expenditure Patterns:*

Unfortunately data collection in this exercise was extremely complex and the record book information is still being processed. A few tentative figures do emerge:

— An average figure of £125 per month is the total income of households (including wages, gifts, rent, other household enterprises). However, this figure should be treated with great caution as some 50% of respondents earn less than £100 per month. 36% of respondents' incomes were supplemented each month by renting out rooms to lodgers. 38% received substantial (£50 or more) gifts or remittances from relatives every month.

All these figures point to the fact that:

(a) there is a great diversity of wealth amongst households in Epworth. The upgrading programme should be flexible enough to cater for these different levels.

(b) Incomes tend to be somewhat precarious and greatly supplemented by gifts and rentals. Therefore monthly payments for services and housing is not a well established principle in the area. This aspect of the upgrading programmes will require a great deal of public relations/education on the part of Ministry officials.

As and when the new data has been collected and analysed, this will be circulated.

Two Case Studies from Sierra Leone

Two case studies are discussed to illustrate the environmental issues and problems in urban industrial development.

These are the Sierra Leone Petroleum Refinery Corporation and the Marampa Mining Company.

(a) **The Sierra Leone Petroleum Refinery Corporation**

The Sierra Leone Petroleum Refinery Corporation refines imported crude oil into petrol, diesel oil, kerosene, fuel oil and liquidefied petroleum gas. These products are marketed by Mobil, Texaco, Shell and British Petroleum Companies. It has an annual distillation capacity of 700,000 tons.

This company has a fire and safety department that is headed by a senior member of staff. The department is well equipped with adequate fire fighting equipment and these are installed all around the plant. Hence the fire fighting measures are satisfactory. The workers are supplied with safety-boots, helmets, overalls, etc. Also training facilities are provided for each worker and this has improved safety consciousness in the factory.

However, the mechanical workshop needs attention. Some of the rotating machinery are not properly guarded, eye shields are not provided for on-site welding. Rubber mats are not provided in front of electrical switch panels.

(b) **Marampa Mines**

This is a joint venture between Sierra Leone Government and an Austrian Mining Company and the operation mainly involves mining and washing operations.
On investigation the following were observed;
The personnel who did the conducted tour claimed that there were no health and safety problems in the concern. However, this is what was observed:

(1) The grinding plant was open and exposed, and this is a very high voltage device, hence it can kill someone in the event of someone rolling in it.
(2) The roads within the mines are very badly constructed and dusty. Since they are used by heavy trucks they give off a lot of dust which is inhaled by the workers.
(3) The run-off waste water from the washing plant which is highly acidic joins an artificial lake which is located on a previously productive land.
(4) There are also other effects, for example, some rice farmland now cannot be used as the acid water from the artificial lake has destroyed it.
(5) The blasting in the mines is destroying houses in the immediate environs.

SAMPLE UNITS:

Generalizations

(1) Unguarded rotating machines can be dangerous to workers.
(2) Industrial accidents can be minimised greatly if protective gears are provided and used by workers, e.g. eye shields for welding, crash helmet for protection against falling objects, rubber mats to prevent electrocution, protecting cover against dust, etc.
(3) Arable agricultural land can be lost due to deposition of industrial waste.
(4) Tremors resulting from mine blasting can affect nearby structures.

SPECIFIC OBJECTIVES:

(1) Workers to know the dangers of unguarded rotating machines.
(2) Workers should be aware of the dangers resulting from absence of protective gear during industrial operations.
(3) To create awareness about environmental hazards caused by industrial operations e.g. loss of arable land due to preposition of industrial waste, destruction of structure by tremors, and effect of noise on hearing.

TOPIC I

Industrial accidents:

Lead a discussion on industrial accidents; discussions should bring out the following causes:

(a) Unguarded rotating machines.
(b) Falling objects.
(c) Exposure to industrial pollutants e.g. naked light from welding, dust, toxic and other substances, noise with high decibels (above 90db).
Learners should discuss the ways of preventing industrial accidents:
(a) Proper use of machinery.
(b) Proper use of protective gear.

Head and Eye Protection

Hand Protection

Safety Eyewear

Foot Protection

Fig. 44: *Protectives against industrial accidents.*

TEACHING AIDS:

Pictures showing proper use and misuse of machinery.
Pictures showing proper use, misuse or non-use of protective clothing.

TOPIC II

Industrial Hazards:

(1) Explain the meaning of environmental hazards caused by industrial operations.
(2) Lead a discussion on the loss of arable land due to deposition of industrial waste and destruction of structures by tremors caused by mine blasting.
Lead a discussion on the prevention of environmental hazards caused by industrial operations. The discussion should bring out the following points:
(a) Proper planning and management of industrial operations.
(b) Pre-treatment of industrial wastes so as to render them non-toxic or harmless.

Fig. 45: *Maximum attentiveness is needed when operating machines.*

TEACHING AIDS:

— Pictures showing the consequences of environmental hazards caused by industrial operations e.g. arable land destroyed by industrial waste. Dwelling houses affected by tremors caused by blasting.

ASSESSMENT:

(1) Visits to industries during operations.
(2) A comparative study of the number of accidents before and after the learning activities.
(3) Questions and answers on the causes, consequences and prevention of accidents and environmental hazards.

OUTLINE OF CONTENT TOPICS

The content suggested below is expected to satisfy the objectives outlined above and can be summarised as such:

(1) The legal framework with respect to industrial operations as related to environment.
(2) Economy of the country—a brief study of the national economy including the way in which industrial projects are financed.
(3) National priorities—this will include a study of the national development plans as related to industrial development and the environment.
(4) The structure of industry—include scale of operation and possible hazards in their production processes.
(5) Environmental problems due to the industrial processes, the social, political, economic and ecological impact on the society due to these problems.
(6) The corrective measures to tackle the various environmental problems outlined.
(7) The monitoring of industrial operation in order to identify possible hazards to the workers.

Example of a Teaching Unit: HOUSING

Procedures to be followed when constructing in an Urban Area

The aims and or objectives of teaching this topic would be:—

(1) To enable urban dwellers to acquire the knowledge of the correct procedures required for house construction;
(2) To make urban dwellers become aware of the different qualities of building materials and the options available for house construction;
(3) To make urban dwellers become aware of the importance of following building plans when constructing houses;
(4) To make urban dwellers become aware of specifications of the buildings and property (land); and
(5) To conscientise or conscentilise urban dwellers on home safety.

Strategies of Attaining these Objectives

The following are some of the strategies of attaining the foregoing objectives:—

(a) Group meetings.
(b) Field visits to houses.

Suggested Activities

The following are some of the activities that may be undertaken:—

(a) Community projects
(b) Mobilisation activities
(c) Demonstration unit followed by talks or any other activity.

Instructional Aids

Appropriate instructional aids may be chosen from the following:—

1. Boards such as chalkboards, magnet board, and flannelgraph.
2. Charts such as wall charts and flipcharts.
3. Posters.
4. Human beings.
5. Models and exhibits.
6. Real objects.
7. Audio visual equipment.
8. Pictures—still and motion.
9. Radio and television.
10. Cassettes.
11. Books, pamphlets, booklets and handouts.
12. Drama and theatre.
13. Demonstration unit.

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13
METHODOLOGIES AND INSTRUCTIONAL AIDS

13.1. METHODS USED IN ADULT EDUCATION

Adult education must be people-centred. Ordinary formal schools tend to reward those who are stronger and leave the weak behind. Adult education should do just the opposite. It should help those who are weakest to become stronger and self-reliant.

To become effective adult educators, extension workers, community development workers, and others who deal with adults, must develop approaches different from what most of us experienced at school. These educators need to develop and practise methods that can help ordinary working people gain awareness and courage needed to improve their situation.

It is therefore important to note that *how* something is taught is as important as *what* is taught. And the most important part of *how* something is taught is the *caring*, *respect* and *shared concern* for the learners that go with it.
It is thus necessary to adapt our teaching methods to people's traditional ways of learning—ways which they are already used to and enjoy, and to improve on them.

The four themes in this Manual summarise the main activities of ordinary working people in any given society, but more particularly so in the Africa Region. These activities can be summed up as production for consumption and maintenance of life, and reproduction for the continuation of society. On the one hand, the themes of Agroforestry and rural development, together with urban and industrial development are concerned with production; and on the other environmental health and population themes concern the reproduction and continuation of the life of society. Perhaps more important is the interrelationship among these four themes, and how the success or failure of one affects all the others and vice versa. Hence the need to regard the themes as wholly interlinked, and the methods as interrelated, changing and not fixed.

Adult education should aim to build the students' confidence in their capacity to *observe*, *criticise*, *analyse* and *figure out things for themselves*. They need to learn to co-operate rather than compete. They need to be encouraged to consider the whole social context of their own needs and look for imaginative and courageous ways of meeting them. Such an education is *for change*.

Emphasis should be more on learning than teaching. Students need to be encouraged to voice their own ideas and feelings, figure out ways and means of helping and freeing themselves from the causes of poverty, poor health and constant famine. Students must have the freedom to discuss their learning needs among themselves and their tutor, and participate in planning and organising their own learning programmes.

A good adult educator is a good group leader who does not dictate but facilitates learning. He treats the students in a friendly relaxed way; and as *equals*.
A good adult educator, whenever possible,

- Draws information out of the students from their own experience.
- Uses words the students understand, and checks now and then to ensure that they *do* understand.
- Asks a lot of questions to encourage students to think critically and figure out things for themselves.
- Emphasises the most useful ideas and information.
- Uses teaching aids that are available locally and are as close to real life as possible.
- Encourages learners to relate what they have seen and learned to real needs and problems in their own communities.
- Emphasizes practical activities in form of community projects, self-help programmes and other self-reliant activities.
- Ensures that all community projects have the approval of the people they are intended to benefit, and that the people have been involved in their planning and implementation from beginning to end.

13.2. INSTRUCTIONAL AIDS AND TECHNIQUES

Adult educators have at their disposal a number of teaching aids and techniques which they can use to ensure that information reaches people for whom it is intended. Only some of the more important aids and techniques will be discussed. We shall begin with techniques.

(a) *Lecturing.*

This is the most used and most misused technique of them all. But it has been found to be appropriate in the following circumstances

- When the group to be dealt with is very large.
- When large pieces of information have to be delivered quickly.
- When a complicated topic has to be introduced, and when there is need for a comprehensive explanation to be offered.
- When the lecture is short.

This method has the main disadvantage because communication is usually from the teacher to the students in one-way flow. It tends to assume that the teacher is more intelligent and the students are dull, the teacher is the depositor of knowledge which the students are the depositories—just like receptacles. But with careful planning lecturing can be effectively used as outlined above.

Fig. 46: *Demonstration class.*

(b) *Demonstration.*

This technique advocates that 'seeing is believing'. It enables participants to come in contact with real life situations, such as preparation of nutritious dishes for the family, building of Blair toilets, construction of wells, preparation of oral rehydration solution, etc. For a demonstration to be accepted, it may be useful to observe the following important points.

- There is need for the use of local and easily available tools, materials and ingredients.
- The demonstration must be conducted in an environment where everybody will see without obstruction.
- Each step must be clearly explained in a simple familiar language.

(c) *Role-Playing*

This is a technique which provides a realistic and lively way of practising skills that involve working with people. It is especially useful for training persons who are more used to learning from life than from books.

In role playing we have adult learners act out real life situations. Some may pretend to be persons with particular illnesses or problems. Others may play the roles of health workers, relatives, and so on, depending on the message intended to be passed on to the audience.

Fortunately, for role playing, no written script is needed, and no memorisation of parts. Role playing is one of the best ways to bring learning close to real life and make it fun.

Role playing is especially useful for developing the following practical skills; social skills of community leadership and organisation; social awareness such as observation and critical analysis; and of teaching skills such as being able to look at different approaches to education and practising appropriate teaching methods.

Because it initiates real life situations, role playing requires students to combine a range of skills and understanding. They must think things through and use to the full extent their powers of observation, analysis, imagination and human feeling.

Role playing has sometimes been used as part of a process to get a whole community thinking and taking action to meet their needs. In Zambia role plays have been used to explain about sexually transmitted diseases (STDs) in such a manner that people who previously had been too ashamed to go for treatment were seen in long queues in hospitals after the plays.

(d) *Dramatic Skit*

The aim of drama may be to expose a social problem, to reinforce learning and understanding, or to provide information and ideas in a lively stimulating way. Here, a plot or a story is prepared and rehearsed in advance. A good play will be remembered and go more deeply into the audience's mind than, say, many classroom activities and lectures. Puppet-shows using masks or "giant heads" can be employed to act out stories or messages, exploring difficult social issues such as pointing out conflicting interests without causing personal offence.

(e) *Stories, Proverbs and Songs*

African societies are rich in traditional songs, dances, proverbs and stories. Most of these cultural activities express and summarise the wisdom and experiences, customs and beliefs, of the different societies; and they often contain many important educational elements.

Adult educators can make great use of this rich cultural source in their effort to reach a wider audience and to make their work more effective. There is, however, need to begin on research to establish the kind of stories, proverbs, songs and dances available and appropriate before an attempt can be made to use them in the delivery of messages.

Fig. 47: *Story telling is effective.*

The main object of these methods should be to help people gain confidence in themselves and pride in their own culture. Care must be taken not to make local ways or persons

look all bad, and outside ways or persons look all good. It is important to mention the weakness of local custom side by side with a custom that is beneficial. For example, if a story tells of a traditional healer who does something harmful, it is best if another traditional healer (rather than an outsider) finds out and shows the people a better way. In some other examples this may not be possible. But the important message is to make the people generate confidence in themselves and their ability to solve their own problems.

(f) *Seminars and Workshops*

Here a larger group is broken into smaller groups which in turn select their own leader, or are led by some specialists in the subject. The groups either select their own topic for discussion, or seminar organisers assign topics to respective groups for discussion. Discussions encourage people in the group to participate.

(g) *Field trips and Field days*

Participants/students are taken on field trips or to participate in field days, and in this way they are put in close contact with the reality of the situation. By seeing and discussing with successful individuals or communities, participants/students will be in a position to learn a lot of things which they adopt or adapt in order to improve their life styles. For a field trip/field day to be successful, a lot of preparatory work is needed. This work involves making preliminary visit(s) by the tutor and one or two members of the group to carry out a survey. The survey will make it easier for the tutor and a few members of the class to play an active role by taking a lead in exploring the area, and provoking the right kind of questions.

(h) *Panel discussion, symposium and debate*

(i) *Panel discussion*—relates to a conversation between three, four or more persons chosen for their knowledge and interest in a particular subject. They conduct the discussion in front of an audience which participates through questions and comments in the latter part of the programme.

(ii) *Symposium* refers to a number of short speeches from two or more speakers chosen for their knowledge and interest about the subject of the symposium. They make their contributions in respect to that subject before a target audience. The latter joins in the symposium by way of questions and comments in the latter part of the symposium.

(iii) *Debate* is where the views for or against an issue are put in a controversial and provocative style, and are represented by two groups of speakers—one represented by two groups of speakers—one group for and the other against the motion. The target audience joins the debate after the two groups have made their statements. After comments from the audience, the leaders (i.e. the principal proposer and opposer) sum up their views. This is usually followed by voting to find out which view-point has more or less support.

The debate technique is useful in sharpening the student's capabilities to learn and understand the details of the subject matter before putting them across to the target audience. It also teaches public speaking.

13.3. TEACHING AND LEARNING AIDS

Aids have been found to be extremely useful in the exercise of teaching and learning because they speed up and improve communication, and provide several approaches to teaching and learning. Aids help students learn better because they are put in close contact with the reality of the problem. Before using aids, it is important to consider the following:

(a) A class in which the teacher merely talks down to students without their participation is a dull class.

(b) A class in which students *take part in discussions* is more interesting than a class in which the teacher merely lectures.

(c) A class in which students *see for themselves* what things look like and how they work is more interesting than a class in which the students merely discuss among themselves and the teacher.

(d) A class in which students not only discuss and see but actually *do and make and discover things* for themselves is far more exciting than the previous three.

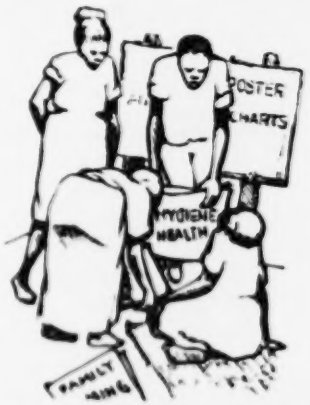

Fig. 48: *A good adult educator involves his students in the learning activities.*

Having discussed the importance of active student participation in the Teaching process, let us explore a few points regarding appropriate use of teaching/learning aids.

The first consideration is to use appropriate and relevant teaching aids. The problem is what is appropriate and relevant?

1. A teaching/learning aid must take into account the needs of the students—which is to develop self-reliance in both doing and thinking, and to find out things for themselves.
2. Imported or foreign-made teaching/learning aids do not satisfy the above conditions. Therefore the adult educator must make his/her own teaching aids, using low-cost local materials.
3. In making these teaching aids the adult students should be involved. This is possible if students and the community are actively involved in making the aids.
4. The aids should be as natural and lifelike as possible. Where enlargement has been made, e.g. in case of bacteria small insects and other cases, this should be explained to adults.

Many and varied teaching/learning aids are available, but only some of these will be touched on.

(a) **Posters**

These are appropriate when the message is meant for campaign purposes, or when the audience or community are to be persuaded to adopt a new or different idea. Posters are useful in campaign e.g. for clean water, appropriate methods in agriculture, family planning, ect.

(b) **Pictures**

Like posters, these too convey the message in a similar way. Care must be exercised in ensuring that they are as local and relevant as possible. In fact pictures taken by an adult educator are more likely to have the desired effect than 'foreign' ones.

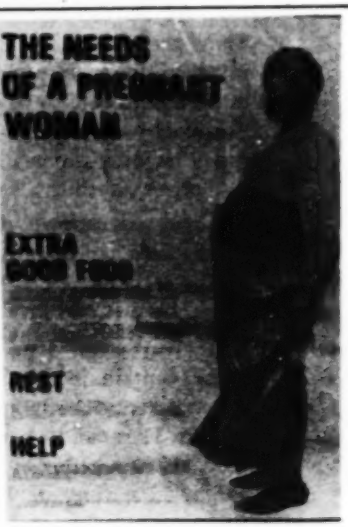

Fig. 49: *Posters are a useful means of passing a message.*

(c) **Slides and films**

Here pictures are projected on the screen by a projector and appropriate commentaries should be directed towards important features contained in each slide or frame. Where necessary the film can be stopped and discussion held before moving onto the next frame.

(d) **Flannel-Boards (Flannel-graphs)**

A flannel-board is a display board on which one can easily place and remove pictures. Pictures for the flannel-board can be drawn by students, teachers or cut from magazines or posters.

A flannel-board needs not be expensive. A simple one can be made using a blanket thrown over a chair or a chalkboard. Pictures will stay better if the surface is tilted backward somewhat.

Various methods for making pictures stick on the flannel-board are available. Cheap ones include gluing flannel, sandpaper, or soft cloth on the backs of pictures so that they can stick to the flannel-board. Another method is to make a paste of flour and water, smear it on the back of the pictures and then sprinkle any grain chaff or husk (e.g. rice, wheat, maize, etc.) over the wet paste. A tiny barbs of the chaff will hold pictures on the blanket flannel-board.

(e) **Flash cards**

These are cards showing a series of pictures or messages. They are useful in telling stories or teaching skills step by step. They can be varied depending on what ideas are to be emphaized. Flash cards can be used to:

- teach basic concepts of health care, population and any other topic.
- start discussions that help the students to think critieally about the problems which affect them.
- play educational games.

Flash cards can be drawn on cardboard or heavy cloth that can be rolled up for carrying.

(f) **Flip Chasts**

These contain pictures which are hand drawn, mimeographed or silk-screened. They can be used as aids for telling stories or teaching skills step by step. They can be held together in several ways. They can be rolled on a stick, linked together or made into flip charts. They can be attached together by gluing, sewing, stapling, etc.

(g) **Radio and television**

These are meant to reach a wider target group than would be possible by use of other methods. Radio, in particular, has been used successfully in some developing countries to reach a wider audience, e.g. in Zambia, Zimbabwe, Tanzania, Kenya and Nigeria. In Zimbabwe, there is a channel (Radio 4) set aside specifically for educational purposes.